JOURNAL
OF THE
ARNOLD ARBORETUM

VOLUME X JULY, 1929 NUMBER 3

THE PANDANACEAE COLLECTED FOR THE ARNOLD ARBORETUM BY L. J. BRASS IN NEW GUINEA

U. MARTELLI

Plate 18

DURING the Arnold Arboretum Expedition to New Guinea in 1925 and 1926 Mr. L. J. Brass collected some Pandanaceae chiefly in the Gulf Division of the Territory of Papua in the region of the Vailala River which empties into the sea at about 150 miles northwest of Port Moresby and also in the region of the Laloki River which runs along the coast between Redscan Bay and Port Moresby. These Pandanaceae were kindly sent to me in 1927 for study by Mr. C. T. White of Brisbane who had undertaken to determine the collections of the expedition. I at once determined the material sent, but did not publish the results at that time. I now present here an enumeration of the Pandanaceae collected by Mr. Brass with descriptions of those I consider new to science. I also have included a Freycinetia collected in Papua Territory by Mr. Lane Poole who visited that Territory some time ago and published in 1925 a very interesting report entitled: "The Forest Resources of the Territories of Papua and New Guinea." Of this Mr. White also forwarded to me a specimen. I am greatly obliged to Mr. White for having entrusted to me the study of scientific material of such importance.

The types of the new species are in the herbarium of the Arnold Arboretum except when stated otherwise.

Freycinetia stenophylla (Sectio Oligostigma) Warburg in Schumann & Lauterbach, Fl. Deutsch. Schutzgeb. Südsee Nachtr. 53 (1905).

Laloki River, alt. 370 m., in riverine rain forests, no. 546, ♀ Oct. 30, 1925 (In Herb. Martelli, in Herb. Arnold Arboretum).

Freycinetia sp. (indeterminanda).

Fr. stenophyllae Warburg valde proxima (♂).

Murna River, Gulf Division, alt. 100 m., in the rain forests, no. 1332.

Freycinetia Beccarii (Sectio Oligostigma) Solms-Laubach in Ann. Gard. Bot. Buitenz. iii. 100 (1883), non Hemsley.

Thur, Vailala River, large rain forest, no. 929, Oct. 10, 1926 (♀).

Freycinetia fibrosa, spec. nov. (Sectio Oligostigma).

Caulis 5–7 mm. crassus, internodis 1 cm. longis, ramulis longiuscule foliosis. Folia patulo-ascendentia, subcoriacea, lanceolato-linearia, 25–40 cm. longa, 1 cm. lata (in planta ♂ 5–7 mm. lata) superne longe attenuato-acuminata et brevi spatio canaliculata, in parte basilari subaequaliter loriformia, 7 mm. lata, ima basi semi-amplectentia haud vaginantia, utrinque longitudinaliter dense venosa; marginibus dentibus subdistantibus, brevissimis, crassiusculis, acutiusculis, basim versus subhorizontalibus, in reliqua parte minutissimis acuminatis et divaricatis; costa media, in pagina inferiore, tenuissima et a medio ad apicem spinis parvis, sursum curvis, subdistantibus munita; auriculis (stipulis) in numerosas fibras intricatas elongatas caulem et basim foliorum ut in Palmis involventes solutis. Inflorescentia ♂ terminalis, spathis brevibus 3 cm. longis ovato-lanceolatis acuminatis; spatha exteriore longissime caudata; marginibus et costa media apicem versus acutissime serratis; pedicellis tenuibus, 17 mm. longis, cum parte staminifera oblonga, 4 mm. elongata; inflorescentia ♀ terminalis, 1–4, brevis, a spathis nonnullis brevioribus lanceolato-acuminatis suffulta; pedicellis brevibus, 1.5 cm. longis, tenuibus (2 mm. crassis). Syncarpia oblonga, 2–3.5 cm. circiter longa, 1.5–2 cm. diam.; baccae numerosae, lageniformes, pentagonae, 7 mm. longae, 3 mm. crassae, in parte superiore 3 mm. longa, liberae et in rostrum pyramidatum acute angulosum, vertice angusto, truncatum producta; stigmata 2–3; semina parva 1 mm. longa, curvula, a raphe et strophiolo angusto cincta.

Hokoro, Vailala River, 100 m. alt. in the rain forests, no. 1048, Febr. 22, 1926.

This species was collected for the first time by Dr. Schlechter in 1908 "in den Wäldern des Rand-Gebirges, Kaiser-Wilhemsland" at 1000 m. alt.: Schlechter, Pflanzen des Monsun-Gebietes, nos. 16675, 17702 (in Herb. Berlin). In 1912 Dr. Ledermann found it again during the Kaiserin Augusta-Fluss Expedition, at Lago, April 18 (Ledermann, no. 9772) and at Etappenberg, 850 m. alt. (Ledermann, no. 8954 [♀], no. 9190 [♂], in Herb. Berlin).

Freycinetia pseudo-insignis (Sectio Oligostigma) Warburg in Engler, Pflanzenr. IV–9, p. 33 (Pandan.) (1900).

Thur, Vailala River, no. 1052 (♀).

Freycinetia Lauterbachii (Sectio Oligostigma) Warburg in Engler, Pflanzenr. IV–9, p. 34 (1900).

Hydrographer's Range, all through the rain-forests from sea-level to 1800 m. alt., *C. E. Lane Poole*, no. 236, Aug. 1922 (in herb. Martelli).

Pandanus tectorius (Sectio Keura) forma.—Solander, Prim. Fl. Ins. Pacif. 350 (ined.)—Parkinson, Jour. Voy. South Sea (1773).

Pandanus odoratissimus Linnaeus fil., Suppl. 424 (1781).

Kerema, Gulf Division, common on the sea beach, no. 1228, March 25, 1926.

The specimen consists only of one leaf, a portion of the male inflorescence and some few unripe phalanges. Under these conditions it is not possible to determine whether this form of *P. tectorius* can be referred to one of the forms already known from New Guinea or not.

Pandanus scabribracteatus, nov. spec. (Sectio Keura).

Arbor 7 m. circiter alta, in parte apicali pluriramosa, stipite ad basin radicibus aëreis crassis suffulto. Folia 2–2.5 m. circiter longa, 8–10 cm. lata, glaucescentia, in apice sensim attenuato-acuta, utrinque et praecique ad apicem longitudinaliter perspicue venata, marginibus serratis, costa media in pagina inferiore prominente, ad basim late triangulari, irregulariter acute denticulato-serrata. Spadix ♀ circiter 40 cm. longus, curvus (?), rachi acute trigona, crassa, in parte inferiore spathis viridibus foliis brevioribus subsimilibus munitus, in parte superiore (florifera) plurimis spathis conspicuis albis armatus; haec spathae superiores, parce dissitae, caducae ?, crasse coriaceae, ovato-lanceolatae, naviculares, acutae, profunde concavae, interdum basin versus angustatae et ima basi in dorso gibbosae, 14–20 cm. longae, 7–8 cm. latae (ad basim), dorso carinatae, in pagina inferiore venulatae et rugoso-sagrinato-scabrae, in superiore profunde concavae et, praecipue in parte basilari, longitudinaliter venatae et transverse tessellatae, scabriusculae, marginibus et carina inermibus. Syncarpia, in specimine nostro, 4, non conferta, in racemo subflexuoso disposita, in axilla unumquodque spathae involventis situm sessilia; phalanges plurimae, pluriloculares.

Lepokera, Vailala River, no. 987, Febr. 16, 1926.

Pandanus Brassii, spec. nov. (Sectio Keura). Plate 18, fig. A.

Arbor 4–6 m. alta, trunco fusco-nitido, radicibus aëreis orbato, superne 4–5 ramis inter se distantibus, divaricatis, ascendentibus. Folia circiter bimetralia, coriacea, glauca, basim versus vix sensim latiora, in dimidia inferiore parte et ultra profunde plicato-canaliculata, in parte superiore expansa (7 cm. lata) et longissime sensim angustata et acuminato-subulata, utrinque, sed praecique in pagina inferiore, crebre longitudinaliter venosa; marginibus basilaribus parum dentatis, dentibus brevibus, subulatis, divaricato-ascendentibus, in reliqua parte nudis vel cum raris et minutissimis dentibus; plicis lateralibus vix notatis et inermibus; costa, media in pagina inferiore, angusta, inermis, basin versus tantum aliquibus dentibus brevissimis munita. Syncarpium pendulum, solitarium, globosum, pedunculo elongato circiter 40 cm., 2 cm. crasso, angulato, acute trigono; phalanges obpiriformes, 8 cm. longae, 5 cm. latae, persaepe compressae, 3.5–4.5 cm. crassae, pentagonae, faciebus planis haud rimosis, in tertia superiore parte liberae, convexae, ibique longitudinaliter a numerosissimis cicacitribus linearibus suberosis notatae, in ⅔ inferioribus connatae, sensim in basim angustam attenuatae, superne subplanae, convexiusculae, a loculis 6–10 superatae; loculis a sulcis angustis haud profundis separatis, pyramidatis, plusminusve

prominentibus, subirregulariter pentagonis, in basi latis, 1–2 interioribus subminoribus, vertice subpapilliformibus cum stigmate verticali, haud prominente; endocarpium osseum, in medio phalangis locatum, 3.5 cm. spissum, ambitu rotundatum, superne sulcato-rugosum, inferne subtruncatum; mesocarpium superum 1.5 cm. spissum, lacunosum, medullosospongiosum, inferius 2.5 cm. spissum, fibrosum.

Domara River, Eastern Division, on small areas of open grass land near coast, no. 1604, May 31, 1926.

Pandanus leptocarpus (Sectio Bryantia) Martelli in Webbia IV. pt. I. 21 (1913); pt. II. t. 33, fig. 8 (1914), sine descriptione.

Folia ultra unum metrum longa, 3.5 cm. lata, subcoriacea, acute et anguste plicato-canaliculata, utrinque longitudinaliter crebre et minute striata, in pagina superiore minutissime tessellata, sursum sensim attenuato-acuminata, in apice subulata, in basi dilatata et late amplectentia, levia; ad margines dentibus minutis munita, basim versus latiusculis, propinquis, longiusculis, sursum curvatis et subulatis; costa media acuta, in fere dimidiam superiorem partem dentibus distantibus, minutissimis praedita. Syncarpium cylindricum, 30 cm. longum, 15 cm. diam., rubro-aurantiacum et virescens (Versteeg). Drupae confertae, lineares, prismaticae, penta-hexagonae, basim versus attenuato-caudatae, in sicco rubro-aurantiacae, 5 cm. longae, 4 mm. latae, pileo apicali brevissimo 5 mm. longo penta-hexagono, pyramidato-subrotundato in vertice explanato, discoideo, anguloso a superficie stigmatica fere repleto; mesocarpii pars superior alba, medullosa, 2.5 cm. longa, pars infera fibrosa; endocarpium lignosum, tenue, infra medium drupae situm, 9 mm. longum, oblongum.

Dutch New Guinea: Noord River, *Versteeg*, no. 1101, in 1907 (type in herb. Utrecht). Territory of Papua: Kiva, Vailala River, on slow swampy river bank, *L. J. Brass*, no. 1164, March 16, 1926.

In 1913 in my Enumerazione delle Pandanaceae, in Webbia (l. c.) I published this new species, collected by Mr. Versteeg on the Noord River (Versteeg, no. 1101) in Dutch New Guinea during the expedition in 1907, but I gave no description of it. The Versteeg specimen is in the Utrecht herbarium.

Pandanus kivi, sp. nov. (Sectio Lophostigma).

Arbor gracilis, 4.5–7 m. alta, ramosa, trunco basin versus spinis brevibus sine ordine sparsis instructo, apicem versus cicatricibus foliaceis notato (Brass). Folia 120–180 cm. longa, angusta, sensim attenuata, acuminata, intense viridia, coriacea, in dimidia inferiore parte plicata et anguste canaliculata, in reliqua parte plana, 4 cm. lata; in pagina inferiore, in dimidia superiore parte, longitudinaliter minute venata, in dimidia inferiore cum venis evanescentibus, plicis lateralibus acutiusculis et apicem versus in pagina superiore parce et minute denti-

culatis, costa media, in pagina inferiore, angusta et acuta, ultra mediam partem tantum usque ad apicem minute serrata, dentibus brevissimis, minutis congestis inaequaliter dispositis et interdum geminis. Syncarpium solitarium cernuum, pedunculo trigono, circiter 20 cm. longo, in basi tenui (1 cm. diam.), nudo, in apice 4 cm. crassa, spathis confertis, imbricatis, in plurimis ordinibus dispositis induto; spathae decrescentes, naviculares, lanceolato-ellipticae, exteriores 30 cm. longae, 8 cm. latae, crasse coriaceae, interiores cartilagineae; marginibus plus minusve minute breviter serratis; syncarpium circiter 20 cm. longum, spathis involutum, conicum, circiter 7 cm. diam. (ad basim); drupae dense adpressae, numerosissimae, prismatico-paulum-cuneatae, hexagonae, maturae 17 mm. longae, 4–5 mm. diam., connatae, apice brevissime pileatae, hic subliberae; pileo (2 mm. spisso) convexiusculo-subplano, in sicco vix rugoso cum areola levi centrali subconcava; stylus subeccentricus, parvus, adpressus, depressus, interdum ex abrupto adscendens, supra planus, levis, flabelliformis; stigma subdigitatum, nigrescens; endocarpium osseum, cuneato-oblongum, sursum rotundatum, 9 mm. longum; mesocarpium superum cavernoso-fibrosum, 3 mm. longum, inferum fibrosum, 5 mm. longum.

Lower Mori River, Eastern Division, on the river bank, no. 1557, May 28, 1926.—Indigenous name: "Kivi."

Pandanus Lauterbachii (Sectio Agrostigma) Schumann & Warburg in Engler, Pflanzenr. IV–9, p. 81 (1900).

Lepokera, Vailala River, in swampy rain forest, no. 986, Febr. 16, 1926 (in Herb. Martelli and Arnold Arboretum).

Pandanus ihuanus, spec. nov. (Sectio Acrostigma).

Dumosus, cum stipite ramoso, circiter 30 m. alto. Folia numerosa, cernua, circiter 2.5 m. longa, late linearia, lanceolata, 6 m. lata, apicem versus sensim attenuata et in acumen breve subulatum desinentia, coriacea, utrinque, sed praecipue in pagina superiore, conspicue longitudinaliter venata et transverse venulato-tessellata; marginibus serratis vel cum dentibus brevibus, tenuibus, distantibus, subhorizontalibus; costa media in parte basilari longo spatio, aculeis brevibus, crassiusculis, reversis armata; plicis lateralibus in pagina superiore et apicem versus crebre aculeatis, interdum aculeis in duplici serie dispositis; folia ramulorum juvenilium parva et inermia (fide Brass). Syncarpium solitarium, globoso-trigonum, 11–12 cm. diam., rufum, pedunculo 1.5 cm. crasso, erecto, acute trigono, brevi (12 cm.), plurimis bracteis subapproximatis deciduis suffultum; drupae numerosae, in toto 4.5 cm. et ultra longae, in parte inferiore connatae, in superiore liberae; pars inferior seminifera 2 cm. longa, cuneata, in apice 6 mm. crassa, basi acuta; pars superior in maturitate facile secedens, crassiuscule coriacea, 2.5 cm. longa, (in sectione longitudinali medullosa) acute hexagona, cum faciebus inaequalibus, planis et levibus, e tertia superiore parte (ubi est etiam 8

mm. crassa, asymmetrica, plus minusve subgibbosa) usque ad basim attenuato-cuneata, et in sicco plus minusve valide et acute plicato-costulata; desuper in tertia superiore parte pyramidata et in stylum mucroniformem producta, cum superficie stigmatica angusto-lineari deorsum vergente, 6 mm. longa; endocarpium osseum, tenuissimum, 12 mm. longum, cuneatum, ad basim acutum; mesocarpium inferum subnullum, cum caverna supraseminali subrotundata, circiter 6 mm.

Vailala River, in the rain forest, no. 978, Febr. 15, 1926.

Pandanus pendulinus, spec. nov. (Sectio Acrostigma). Plate 18, fig. B.

Arbor 7–8 m. alta (fide Brass) cum stipite spinis (radicibus aëreis abortivis?) munito, et in summo plurimus ramis coronato, in basi radicibus aëreis circiter 3 m. longis, crassis, grallaeformibus, fibrosis et dense spinosis (spinis, fide Brass, sursum curvis) suffulto. Folia 3–3.5 m. et ultra longa, circiter 10 cm. lata, recurva, coriacea, canaliculata, apicem versus subplana et sensim attenuato-acuminata, in marginibus serrata, cum dentibus basi lata brevibus, patentibus, acutis; in pagina inferiore glaucescentia, longitudinaliter crebre, minute et superficialiter venata; costa media acuta, valide prominens, minute et brevissime denticulata. Inflorescentia ♂ tantum nota, reclinata, spicata, plus quam unum metrum longa, plurimis spathis paulum distantibus vestita, cum rachi crassa; spathis decrescentibus, inferioribus ultra ½ m. longis, lanceolato-sensim-acuminatis, navicularibus; superioribus angustis, lineari-lanceolatis, sensim acuminatis; una spicula elongata in axilla cujusque spathae sita, subsessilis et densissime staminibus omnino tecta; spiculae apice attenuatae, inferiores etiam 20 cm. longae, 4 cm. crassae (ad basim); stamina numerosissima, densissime conferta, sine columna, unumquodque super bulbillum axis spicae affixum; antherae lineares, 2–2.5 mm. longae, apiculatae, immaturae, erectae, densissime confertae, subsessiles, maturae filamento longissimo, tenuissimo, 2.5 mm. longo plus minusve flexuoso sustentae quare antherae pendulae fiant.

Ihu, Vailala River, Central Division, no. 1053, Febr. 24, 1926.

Florence, Italy
April, 1929

FICUS SPECIES COLLECTED FOR THE ARNOLD ARBORETUM IN NEW GUINEA BY L. J. BRASS

V. S. SUMMERHAYES

Sect. PALAEOMORPHE

Ficus acanthophylla, sp. nov.

Arbor parva, ramis crassis cortice laevi griseo obtectis; ramuli subangulares, juventute aculeolis rectis vel leviter curvatis praediti, demum laeves, glabri, pallide brunnei. FOLIA oblonga vel oblongo-obovata, apice breviter acuminata, basi rotundata vel leviter cordata, matura subcoriacea, 14–24 cm. longa, 6–12 cm. lata, juniora utrinque praesertim

nervis aculeolata, supra costa parce aculeolato-pilosa excepta glabra, subtus praesertim nervis venisque pubescentia, matura supra nitida glabra, subtus pubescentia, asperula, costa ut nervi supra prominula subtus valde prominente, nervis lateralibus utrinsecus 7–10 infimis adscendentibus brevibus ceteris patentibus curvatis prope marginem pulchre arcuatim conjunctis, nervis transversis prominulis, rete venularum indistincto; petiolus 1.5–4.5 cm. longus, leviter compressus, supra canaliculatus, juventute aculeolatus, scaberulus, demum sublaevis; stipulae lanceolatae, acutae, circiter 1 cm. longae, extra scaberulae. Receptacula pedunculata, axillaria, solitaria, vel e ligno veteri fasciculata, purpureo-viridia, 2–2.75 cm. diametro, glabra, asperula, flores ♂, ☿ et ♀ cecidiophoros commixtos includentia; pedunculus pro receptaculo gracilis, 2.5–3.5 cm. longus, 1.5–2 mm. diametro, scaberulus, basi bracteis minutis instructus. Flores ♂ saepissime prope ostiolum, pedicellati, perianthii segmentis 4 oblongis obtusis apice subcucullatis staminibus aequalibus; stamina 2, filamentis 0.7 mm. longis, antheris 0.8–1 mm. longis. Flores ☿ floribus ♀ cecidiophoris commixti, 3–3.5 mm. longe pedicellati, perianthii lobis 4 linearibus vel oblongis; stamen 1; ovarium cecidiophorum ellipsoideum vel abortivum, stylo brevissimo. Flores ♀ cecidiophori sessiles vel usque ad 3.5 mm. longe pedicellati, perianthii lobis 5 linearibus liberis ovario aequalibus; ovarium ellipsoideum vel obovoideum, laeve, stylo brevi, stigmate minuto. Flores ♀ non visi.

Kuranin, Eastern Division, no. 1388, May 12, 1926 (small riverbank tree).

The presence of hermaphrodite flowers places this plant in sect. Palaeomorphe although it does not resemble very closely any of the species of that section. The presence of both male and hermaphrodite flowers has been recorded in *F. lamprophylla* Laut. & K. Sch., also from New Guinea, but the two species are quite different in other respects. King describes the rare occurrence of hermaphrodite flowers among the usual 2-staminate male flowers in *F. dumosa* King belonging to sect. Eusyce, and suggests that the species is intermediate in this character between that section and sect. Palaeomorphe.

Ficus adenosperma Miquel in Ann. Mus. Bot. Lugd.-Bat. III. 233, 296 (1867).

Lotoki River, riverine rain-forest, 360 m. alt., no. 550, Oct. 31, 1925 (small tree); Kurandi, Eastern Division, no. 1389, May 12, 1926 (tree 20 feet or more in height, forming dense thicket in river bed).

Vernacular Name:—Boko.

Ficus androbrota sp. nov.

Arbor erecta, 3 m. alta; ramuli teretes, juventute scaberuli, demum glabri, cortice pallide brunneo fere laevi obtecti. Folia breviter petiolata, elliptica vel elliptico-obovata, obtusa vel rotundata, apiculata,

basi rotundata vix cordata, 2–6 cm. longa, 1.5–4 cm. lata, chartacea vel tenuiter coriacea, juventute scabrido-pilosa, demum utrinque glabra, supra scaberula, subtus asperula, costa subtus prominente, nervis lateralibus utrinsecus 7–9 patentibus curvatis subtus prominulis, rete venularum tenuissimo distincto; petiolus supra concavus, 4–6 mm. longus, scaber; stipulae lineari-lanceolatae, acutae, pubescentes, brunneae, scariosae. RECEPTACULA pedunculata, axillaria, solitaria, maturitate nigra, subglobosa, ostioli bracteis prominentibus, 7–8.5 mm. diametro, basi interdum in stipem brevissimum angustata, bracteis basalibus tribus triangularibus subacutis 0.5–1 mm. longis instructa, glabra, asperula; pedunculus 2–4 mm. longus, asperulus. FLORES ♂ juxta ostiolum, sessiles, perianthii segmentis 5 liberis linearibus usque subspathulatis interdum subfalcatis 2–2.5 mm. longis hyalinis ciliolatis; stamen singulum, filamento 0.8 mm. longo, anthera 1.2 mm. longa. FLORES ♀ inter florem ♂ et ♀ cecidiophorum dispositi, pedicellati, perianthio ei florum ♂ simili; stamen singulum, filamento 0.8 mm. longo, anthera 1 mm. longa; ovarium incomplete evolutum, stylo pro rata longiusculo. FLORES ♀ cecidiophori sessiles vel usque ad 2 mm. pedicellati, perianthii segmentis 4–5 liberis linearibus acutis 2.5–3.5 mm. longis hyalinis ciliolatis; ovarium globosum vel obovoideum, stylo infra-apicali brevi, stigmate capitato vel leviter 3–4-lobo. FLORES ♀ non visi.

Kappa Kappa, open coast lands, no. 800, Dec. 8, 1925 (eaten by natives).

This species very evidently belongs to sect. Palaeomorphe where it is closely allied to *F. adenosperma* Miq., a native of Eastern Malaya. In this latter species some of the uppermost gall flowers bear an abortive anther, whereas in *F. androbrota* the hermaphrodite flowers bear perfect anthers, while it is doubtful if the ovaries ever develop properly. *F. adenosperma* differs from the present species in having the stems and under surfaces of the leaves tawny pubescent when young, in the longly acuminate leaves and in the larger hairy receptacles.

Ficus gibbosa Blume, Bijdr. 466 (1825).

U-uma River headwaters, Eastern Division, 450 m. alt., no. 1448, May 18, 1926 (handsome riverbank tree, 20–25 feet).

Ficus subulata Blume, Bijdr. 461 (1825).

Lotoki River, no. 549, Oct. 31, 1925 (large parasitic fig); Ihu, Vailala River, rain forests, no. 907, Febr. 9, 1926 (small tree); same locality, no. 1020, Febr. 20, 1926 (medium rigid tree); Bomgwina River, Eastern Division, no. 1620, June 2, 1926 (large tree over-hanging river, common).

Ficus xanthosyce, sp. nov.

Arbor parva vel usque ad 12 m. alta; ramuli teretes, longitudinaliter striati, scabrido-pilosi, demum glabri, cinereo-brunnei, internodiis usque ad 4 cm. longis. FOLIA petiolata, oblongo-elliptica, elliptica vel oblanceolata, apice subacuta usque breviter acuminata, basi rotundata vel

leviter et interdum inaequaliter cordata, 4–14 cm. longa, 2–5.5 cm. lata, tenuiter coriacea, supra papillis albidis scabridis praedita, costa albido-pilosa demum glabra, subtus praesertim costa nervisque breviter scabrido-pilosa, costa supra leviter impressa subtus prominente, nervis lateralibus utrinsecus 5–10 adscendentibus indistincte vel vix conjunctis, nervis tertiariis manifestis quadratim conjunctis, rete venularum subtilissimo; petiolus supra complanatus vel concavus, 5–10 mm. longus, scabrido-pilosus, cinereus; stipulae lanceolatae, acuminatae, pilosae, cito deciduae. RECEPTACULA pedunculata, axillaria, solitaria usque ternata, subglobosa, 5–7 mm. longa, 5–9 mm. diametro, flava, scaberula, umbilico prominulo, ostiolo leviter depresso, basi in stipem brevem angustata, bracteis basalibus tribus minutis; pedunculus 2–4 mm. longus, scaberulus. FLORES dioici, squamis linearibus hyalinis commixtis; ♂, ☿ et ♀ cecidiophori in receptaculis plantae masculae dispositi; ♀ tantum in receptaculis aliarum plantarum lati. FLORES ♂ prope ostiolum, sessiles vel breviter pedicellati, perianthii segmentis 3 linearibus vel subspathulatis superne coalitis antheram includentibus brunneo-maculatis; stamen 1, filamento 0.5 mm. longo, anthera 0.7 mm. longa. FLORES ☿ prope ostiolum, sessiles vel pedicellati, perianthii segmentis 4 eis floris ♂ similibus; stamen 1, filamento 0.5 mm. longo, anthera 0.5 mm. longa; ovarium imperfecte evolutum, stylo brevi, stigmate apice cavo. FLORES ♀ cecidiophori sessiles vel usque ad 1.5 mm. longe pedicellati, perianthii segmentis 5 basi ± coalitis linearibus vel subspathulatis superne adhaerentibus 2–2.5 mm. longis rubescentibus; ovarium ellipsoideum, laeve, stylo infra-apicali, stigmate apice cavo. FLORES ♀ sessiles vel usque ad 2.5 mm. longe pedicellati, perianthii segmentis 4 liberis linearibus vel subspathulatis ovario saepissime longioribus superne saepe adhaerentibus rubescentibus brunneo-maculatis vel albidis; ovarium compresse ellipsoideum vel ovoideum margine a stylo averso carinatum, rugulosum, stylo laterali, stigmate clavato vel subclavato.

Sogeri, rain forest, 450 m., no. 651, Nov. 16, 1925 (female plant); U-uma River, Eastern Division, no. 1520, May 20, 1926 (small tree in river bed; male-gall plant) (type); Kerema, Gulf Division, rain forest regrowths, no. 1209, March 24, 1926 (female plant).

As with *F. androbrota* Summerhayes the characters place this species in sect. Palaeomorphe although the very rough leaves are not found in most of the other and typical species of the section. From *F. androbrota* itself, to which it seems to be allied, it is separated by the scaly outgrowths on the inside of the receptacle and the more acuminate leaves which are hairy underneath. *F. lima* Laut. & K. Schum., which also has rough leaves, has quite different floral characters and differs in a number of other points. In general characters, apart from the presence of hermaphrodite flowers, *F. xanthosyce* shows considerable affinity with many species in sect. Sycidium.

No. 1209 differs in some respects from the other two specimens the leaves being almost glabrous and of different texture while the perianth of the female flower is colorless. In most characters it agrees with the type and is best included with the others.

Sect. UROSTIGMA

Ficus Benjamina Linnaeus, Mant. 129 (1767).

Lower Mori River, Eastern Division, no. 1573, May 28, 1926 (large riverbank tree).

Vernacular Name:—Ban.

Ficus Rigo F. M. Bailey in Queensl. Agric. Jour. I. 235 (1897).

Rigo, on coast, no. 820, Dec. 9, 1925 (large handsome spreading tree).

Sect. SYCIDIUM

Ficus Armiti King in Jour. As. Soc. Bengal, LV. pt. II. 404 (1886).

Ihu, Vailala River, rain forests, no. 945, Febr. 12, 1926, (small tree); Mowabula, Eastern Division, rain forests, no. 1372, May 11, 1926 (slender tree 50–60 feet).

Ficus Brassii, sp. nov.

Arbor parva, 2–3 m. alta; ramuli teretes, longitudinaliter rugulosi, cinereo-brunnei, glabri, cicatricibus annularibus stipularum delapsarum distincte notati. FOLIA breviter petiolata, anguste lanceolata vel oblanceolata, acuta vel acuminata, apice ipso rotundata, basi cuneata, 10–16 cm. longa, 1.5–3.5 cm. lata, discoloria, coriacea, laevia, supra juventute longiuscule adpresse pilosa deinde glabra, subtus costa longiuscule adpresse pilosa excepta glabra, minute tuberculata, costa supra impressa subtus prominente, nervis lateralibus numerosis e costa angulo 80° exeuntibus prope marginem nervo marginali interiore conjunctis, nervis tertiariis distinctis; petiolus 7–12 mm. longus, supra concavus, glaber; stipulae lanceolatae, acuminatae, extra dense adpresse pilosae, intus glabrae, circiter 3 cm. longae, cito deciduae. RECEPTACULA axillaria, sessilia, solitaria vel gemina, globosa, 1 cm. diametro, laevia, minute rugulosa, viridia, basi bracteis duabus vel tribus latis bilobis lobis ovatis obtusis, ostiolo vix distincto. FLORES ♂ et ♀ cecidiophori per totum receptaculum commixti. FLORES ♂ pedicellati, pedicellis 1–2 mm. longis, perianthii segmentis 3 conjunctis; stamen 1, filamento 0.8 mm. longo. FLORES ♀ cecidiophori sessiles vel pedicellati, perianthii segmentis 3 conjunctis late ovatis; ovarium ovoideo-globosum, stylo laterali, stigmate integro vel 2–3-fido lineari-filiformi 0.5–1.2 mm. longo. FLORES ♀ non visi.

Lotoki River no. 1660, June 17, 1926 (small river bed tree, 6–8 feet hihg).

Vernacular name:—Manamadubu.

I have been unable to find any close relative of this plant. *F. irregularis* Miq. has similarly shaped leaves, but differs in its much smaller,

long-stalked receptacles. *F. Brassii* is probably correctly placed in sect. Sycidium.

Ficus dichroa, sp. nov.

Arbor parva, compacta; ramuli leviter compressi, longitudinaliter striati, scabri, internodiis usque ad 5 cm. longis. Folia opposita, petiolata, elliptico-ovata vel elliptico-obovata, brevissime acuminata, apice ipso obtusa vel fere retusa, apiculata, basi rotundata vel leviter cordata, 12–18 cm. longa, 6–7 cm. lata, chartacea, utrinque scaberula, costa supra prominula inferne leviter canaliculata subtus subprominente, nervis lateralibus utrinsecus 5–8 infimis e costa angulo 40–50° ceteris angulo 50–60° exeuntibus prope marginem irregulariter conjunctis utrinque prominulis, rete venularum tenuissimo vix distincto; petiolus complanatus, 1–2.5 cm. longus, scaber; stipulae parvae, oblongo-lanceolatae, 3 mm. longae, scabro-pubescentes, ciliolatae, cito deciduae. Receptacula pedunculata, axillaria, solitaria vel gemina, fere globosa, 9–10 mm. diametro, scaberula, viridia atque brunnea, ostioli bracteis numerosis prominentibus pubescentibus; pedunculus gracilis, 4–8 mm. longus, scaber, apice in cupulam tenuissimam, 3–4 mm. diametro, receptaculo arcte adnatam, margine bracteas tres deltoideas obtusas ciliolatas ferentem productus. *Flores* ♂ prope ostiolum, sessiles, perianthii segmentis 3–4 linearibus hyalinis superne coalitis; stamen 1, filamento 0.8–1 mm. longo. Flores ♀ cecidiophori sessiles vel usque ad 2 mm. longe pedicellati, perianthii segmentis 3–4 hyalinis linearibus ± coalitis; ovarium globosum vel obovoideo-globosum, stylo infra-apicali, stigmate brevi clavato. Flores ♀ non visi.

Gulf Division, Keura, on the sea beach, no. 1190, March 22, 1926.

This species is very similar to *F. balica* Miq. which however, has the leaves much longer petiolate and the receptacles with long slender peduncles. Only the female flowers are known in *F. balica*.

Ficus eulampra K. Schumann in Schumann & Lauterbach, Fl. Deutsch. Schutzgeb. Südsee, 279 (1901).

Lotoki River, riverine rain-forests no. 556, Oct. 31, 1925 (small tree).

Ficus hystricicarpa Warburg in Schumann & Lauterbach, Fl. Deutsch. Schutzgeb. Südsee Nachtr. 244 (1905).

Bisiatabu, rain forest floor, 450 m. alt., no. 827, Nov. 13, 1924 (shrub 3 ft.).

Ficus saxicola, sp. nov.

Arbor parva, 5 m. alta; ramuli teretes, plus minusve longitudinaliter rugulosi, glabri, cortice cinereo-brunneo obtecti, cicatricibus foliorum delapsorum notati. Folia breviter petiolata, oblongo- vel elliptico-lanceolata, plus minusve caudata, basi subcuneata, 14–18 cm. longa, 2.5–4 cm. lata, coriacea, utrinque glaberrima, supra nitentia, subtus siccitate cuprea, costa supra prominula subtus prominente, nervis

lateralibus numerosis parallelis e costa fere angulo recto exeuntibus rectis prope marginem nervo marginali interiore conjunctis utrinque subprominentibus, rete venularum distincto; petiolus supra concavus, 7–11 mm. longus, glaber, rugulosus; stipulae anguste lanceolatae, acuminatae, extra praesertim prope costam adpresse fulvo-pilosae, 2–4 cm. longae. RECEPTACULA axillaria, solitaria, sessilia, fere globosa, 8–10 mm. diametro, basi bracteis tribus late reniformibus plus minusve bilobis 2–2.5 mm. longis instructa, ostiolo leviter impresso bracteis vix manifestis. FLORES ♂ et ♀ cecidiophori per totum receptaculum commixti, squamis oblongis vel lanceolatis interspersis. FLORES ♂ pedicellati, pedicellis 0.5–2 mm. longis, perianthii segmentis 3 obtusis conjunctis; stamen 1, filamento 0.5 mm. longo. FLORES ♀ cecidiophori sessiles vel usque 2 mm. longe pedicellati, perianthii segmentis 3 vel 4 ovatis vel lanceolato-ovatis 0.8–1 mm. longis basi coalitis; ovarium ellipsoideo-globosum vel ovoideum, stylo laterali, stigmate linearifiliformi 0.5 mm. longo integro vel 2–3-fido. FLORES ♀ non visi.

Iawarere, on rocks at water's edge, 300 m. alt., no. 699, Nov. 25, 1925 (small tree 15 feet high).

This species is closely allied to *F. Brassii* Summerhayes, but differs in having caudate leaves with different shape and venation and the midrib perfectly glabrous on the under surface. The floral characters are very similar, but in the absence of female flowers it is best to consider them as separate species.

Sect. COVELLIA

Ficus Bernaysii King in Jour. As. Soc. Bengal, LV. pt. II. 406 (1886).

Bisiatabu, rain forest, alt. 450 m., no. 569, Nov. 6, 1925 (small shapely tree, 20 feet high).

Ficus casearia F. Mueller ex Bentham, Fl. Austral. VI. 177 (1873).

Hula, in light jungle near beach, no. 527, Oct. 21, 1925 (small tree 10–15 feet); Sogeri, rain forest, 450 m. alt., no. 638, Nov. 16, 1925 (small tree 15 feet); Ihu, Vailala River, rain forest regrowths, no. 1055, Febr. 24, 1926 (small tree).

Ficus Chalmersii King, in Jour. As. Soc. Bengal, LV. pt. II. 406 (1886).

RECEPTACULA flores ♂ et ♀ cecidiophoros gerentia ramis tuberculatis brevibus e tronco exeuntibus disposita, pedunculata, pyriformia, umbilico valde depresso, 2–3 cm. longa, 2.5–3.5 cm. diametro, glabra, laevia, bracteis basalibus nullis. FLORES ♂ prope ostiolum, 0.7 mm. longe pedicellati, perianthii segmentis 3 fere orbicularibus valde imbricatis stamine includentibus; stamen 1, filamento crasso 0.5 mm. longo, anthera 1 mm. longa. FLORES ♀ cecidiophori sessiles vel usque ad 2 mm. longe pedicellati, perianthii segmentis in cupulam membranaceam margine irregularem ovario duplo breviorem coalitis; ovarium maturum subglobosum, stylo primo terminali deinde sub-apicali, stigmate brevissimo.

Ihu, Vailala River, in rain forests, no. 1059, Febr. 24, 1926.

In leaf and branch characters this specimen agrees exactly with the type-specimen of *F. Chalmersii*. Only the female receptacles of this species have been described, and as *Brass* 1059 bears male-gall receptacles only and these are considerably larger than those described by King the identity of the two is not absolutely certain. However, the male flowers have one stamen, thus agreeing with sect. Covellia in which *F. Chalmersii* was placed, while the shape and other characters of the two types of receptacles are very similar. An additional point of agreement is in the perianths of the gall and female flowers of the respective specimens, both being cupular and membranous. The description of the male-gall receptacles is accordingly furnished above to complete the description of the species.

Ficus myriocarpa Miquel in Ann. Mus. Bot. Ludg.-Bat. III. 230 (1867).

Sogeri, riverine rain forest, 450 m. alt., no. 654, Nov. 17, 1925 (spreading tree 30 feet); Ihu, Vailala River, rain forest regrowths, no. 934, Febr. 11, 1926 (small tree 20–25 feet).

Ficus ribes Reinwardt in Blume, Bijdr. 463 (1825).

Sogeri, rain forest, 450 m. alt., no. 647, Nov. 16, 1925 (spreading tree, 30 feet high).

Ficus setistyla Warburg in Schumann & Lauterbach, Fl. Deutsch. Schutzgeb. Südsee Nachtr. 248 (1905).

Upoia, Vailala River, no. 1159, March 15, 1926 (low spreading tree 30 feet high).

Sect. EUSYCE

Ficus calodictya sp. nov.

Arbor erecta, gracilis, 9 m. alta, cortice compacto brunneo; ramuli teretes, sublaeves, glabri, cinereo-brunnei, lenticellis numerosis atro-brunneis notati. Folia petiolata, late elliptica, apice rotundata vel subobtusa, basi rotundata, 3–5.5 cm. longa, 2–4 cm. lata, subcoriacea, margine undulata, utrinque glabra, costa utrinque prominula, nervis lateralibus utrinsecus 4–5 prominulis e costa angulo 50° exeuntibus prope marginem arcuatim conjunctis, nervo marginali nullo, rete venularum subtilissimo; petiolus supra canaliculatus, 7–10 mm. longus, rugulosus, glaber, in laminas tenues quadratas vel polygonas decorticans; stipulae lanceolatae, acutae, 4–5 mm. longae, glabrae. Receptacula pedunculata, axillaria, solitaria vel gemina, pendula, obovoideo-pyriformia, 3.5–4.5 mm. longa, glabra, viridia, basi in stipem brevissimam angustata; pedunculus gracilis, 3–4 mm. longus, apice bracteis ad annulum angustissimum reductis. Flores ♂ prope ostiolum, sessiles vel usque ad 1 mm. longe pedicellati, bractea lineari-lanceolata, 1–2 mm. longa, perianthii segmentis 3 liberis linearibus vel lineari-lanceolatis acutis 1 mm. longis; stamina 2, filamentis 0.7 mm. longis, antheris 1 mm. longis. Flores ♀ cecidiophori sessiles vel breviter pedicellati, perianthii segmentis

2 raro 3 liberis vel basi connatis, purpureo-brunneis; ovarium fere globosum, flavidum, stylo infra-apicali vel subterminali brevi, stigmate minuto. FLORES ♀ non visi.

The Cupola, Gulf Division, rain forest, 150 m. alt., no. 1360, April 1, 1926.

In general characters this plant seems to agree with the sect. Eusyce, but no species in that section seems very closely allied to it. *F. diversifolia* Bl. has larger and differently shaped fruits and very different leaves but has a somewhat similar facies, and may be the closest ally of *F. calodictya*.

Ficus Odoardi King in Ann. Bot. Gard. Calcutta, I. 156, t. 198 (1888).

Ihu, Vailala River, in rain forests, no. 965^A^, Febr. 13, 1926 (scandent).

Ficus rhizophoraephylla King in Jour. As. Soc. Bengal. LV. pt. II. 410 (1886).

Lepokera, Vailala River, in rain forests, no. 989, Febr. 16, 1926 (large glabrous tree).

Sect. NEOMORPHE

Ficus grandis King in Ann. Bot. Gard. Calcutta, I. 170, t. 214 (1888).

Bisiatabu, rain forest, 450 m. alt., no. 606, Nov. 11, 1925 (spreading tree, 40 feet high).

Ficus nodosa Teysmann & Binnendyk in Nat. Tijds. Ned. Ind. XXIX. 245 (1866).

Ihu, Vailala River, no. 1058, Febr. 24, 1926 (pretty little riverside tree with dense crown).

Ficus rhodocarpa, sp. nov.

Arbor parva, 3–4.5 m. alta, cortice pallide griseo; ramuli teretes, juventute scabri, fulvo-brunnei, demum scaberuli, castaneo-grisei, internodiis brevibus. FOLIA saepissime opposita, petiolata, oblanceolata vel anguste obovata, subacuta, basi subcuneata, 4–12 cm. longa, 1.5–5 cm. lata, coriacea, discoloria, juventute scabrido-pilosa, demum utrinque glabra, asperula, supra nitida, costa supra prominula subtus prominente, nervis lateralibus utrinsecus 7–10 infimis adscendentibus ceteris e costa angulo 60–70° exeuntibus prope marginem arcuatim conjunctis utrinque prominulis, rete venularum distincto supra prominulo; petiolus gracilis, supra canaliculatus, 0.6–2.2 cm. longus, scaberulus; stipulae lanceolatae, acutae, membranaceae, asperulae, cito deciduae. RECEPTACULA e ligno veteri exeuntia, fasciculata, longiuscule pedunculata, fere globosa, 10 mm. longa, 10–13 mm. lata, ostiolo prominente, pallide rubra, glabra, minute asperula; pedunculus gracilis, 7–13 mm. longus, glaber, supra medium bractea minuta instructus. FLORES ♂ prope ostiolum, 0.5–1 mm. longe pedicellati, perianthii segmentis 4–5 liberis linearibus stamen aequantibus vel paulo excedentibus; stamina 1 vel 2, filamento 1.5 mm. longo, antheris lateralibus 0.6–0.7 mm. longis. FLORES

♀ cecidiophori sessiles vel usque ad 3.5 mm. longe pedicellati, perianthii segmentis 4 liberis linearibus 2.5 mm. longis breviter ciliatis; ovarium ellipsoideum vel globosum, stylo infra-apicali brevissimo, stigmate apice cavo. FLORES ♀ non visi.

Borabere, alt. 360 m., no. 732, Dec. 1, 1925.

The cauliflorous habit and the two stamens in many of the male flowers should place this species in the sect. Neomorphe, in which, however, it seems to have no close allies. From the description *F. Dielsii* Warburg seems to resemble it closely, but has only one stamen, while in addition the perianth of both male and gall flowers is different and some of the leaf characters do not agree.

Incertae Sectionis

A certain number of specimens, although quite distinct from any described species and worthy of description, cannot be placed with any degree of confidence in any of the sections of the genus.

In these cases the affinities of the species with regard to leaf characters, position of receptacles etc. are often with species belonging to several different sections, and as the specimens lack either male-gall or female receptacles they are best left under the above heading until the other type of receptacle is known.

F. apolepomena, sp. nov.

Arbor patula, 9 m. alta, trunco ramisque in laminas tenuissimas brunneas decorticantibus; ramuli hornotini longitudinaliter sulcati, dense ferrugineo-tomentosi, annotini cinerei, breviter cinereo-tomentosi demum glabrescentes. FOLIA petiolata, elliptica vel oblongo-elliptica, apice rotundata, breviter cuspidata, basi ± leviter cordata, 6–16 cm. longa, 4–9 cm. lata, tenuiter coriacea, supra scaberula, nervis dense ceterum parce fulvo-pilosa, subtus praesertim nervis breviter pubescentia, costa subtus prominente, nervis lateralibus utrinsecus 7–9 e costa infimis angulo acuto ceteris angulo 50–60° exeuntibus prope marginem arcuatim conjunctis, nervis tertiariis transversis manifestis, rete venularum tenuissimo distinctissimo; petiolus compresse teres, 1–2 cm. longus, dense fulvo-tomentosus; stipulae lanceolatae, acuminatae, circiter 1 cm. longae, dense sericeo-tomentosae. RECEPTACULA sessilia, ramulis aphyllis insidentia, sphaeroidea, 1.4–1.8 cm. longa, 1.7–2.2 cm. lata, glabra, minutissime papillosa, scaberula, umbilico vix prominulo, ostioli bracteis depressis. FLORES ♂ prope ostiolum; stamen 1. FLORES ♀ cecidiophori sessiles vel pedicellati; ovarium globosum, stylo brevi. FLORES ♀ non visi.

Bisiatabu, in rain forest, 450 m. alt., no. 575, Nov. 11, 1925.

This plant strongly resembles the Papuan species *F. pteleaephylla* S. Moore which is said to belong to sect. Palaeomorphe. That species, however, has much smaller receptacles on stalks as long as the receptacle. *F. xerophila* Domin, an Australian species, is very similar in appearance

to *F. apolepomena* but has opposite leaves and smaller receptacles. *Ficus trachypison* K. Schum. also has much smaller and very rough receptacles and more acute leaves. The receptacles of *F. apolepomena* are so badly preserved inside, having been attacked by some insect (not the gall insect, the young larva of which are present in each gall ovary) that the characters of the perianth of neither male nor gall flowers can be observed. It is therefore best not to attempt to place the species in any definite section.

Ficus charadrophila, sp. nov.

Arbor parva, circiter 2 m. alta, ramis horizontalibus. Ramuli teretes, juventute dense subadpresse griseo-hispidi, demum glabri, longitudinaliter rugulosi, postremo cortice rubro-brunneo in laminas parvas subquadrangulares decorticante obtecti, internodiis brevibus usque ad 1 cm. longis. FOLIA oblanceolata vel elliptico-oblanceolata, apice leviter emarginata usque subacuta, basi cuneata vel subcuneata, 2–4.5 cm. longa, 1–1.6 cm. lata, marginibus planis, discoloria, subcoriacea, supra juventute pilis parcissimis albidis adpressis, demum glabra, sublaevia, subtus juventute praesertim nervis marginibusque longiuscule albido-pubescentia, costa subtus prominula, nervis lateralibus utrinsecus 6–8 adscendentibus leviter curvatis prope marginem conjunctis, rete venularum conspicuo; petiolus 4–9 mm. longus, superne canaliculatus, dense albido-pubescens, demum glaber; stipulae subpersistentes, linearilanceolatae, acuminatae, 5–8 mm. longae, chartaceae, glabrae. RECEPTACULA axillaria, solitaria, globosa, 12 mm. diametro, bracteis sparsis instructa, ostiolo bracteis numerosis carnosis obtusissimis prominulis circumdato, basi in stipem 2.5 mm. longam angustata, sparse albido-pubescentia; pedunculus 5–8 mm. longus, puberulus, bracteis tribus triangularibus acutis coronatus. FLORES pilis hispidis interspersi. FLORES ♂ circum ostiolum haplostichi, sessiles, perianthii segmentis 5 liberis linearibus 1 mm. longis, stamine singulo, filamento brevissimo. FLORES ♀ cecidiophori sessiles, perianthii segmentis 3 liberis lanceolato-spathulatis 1–2 mm. longis ciliatis ungue laminae aequilongo, stylo laterali glabro, stigmate apice leviter infundibuliformi.

Numa River, Gulf Division, no. 1347, March 29, 1926 (tough, flat-topped small tree, 5–6 feet high, in the beds of swiftly running mountain streams).

I have been unable to find any Malayan or Australian species of *Ficus* at all closely related to this plant, so in the absence of female flowers it is difficult to assign it to any section of the genus.

Ficus clusiaefolia, sp. nov.

Arbor grandis, multiramosa, trunco ramisque radices adventicias demittentibus, cortice laevi griseo obtectis, ramulis longitudinaliter rugulosis, glabris. FOLIA longipetiolata, elliptica vel obovato-elliptica, apice obtusa vel breviter mucronata, basi cuneata, 8–12 cm. longa, 5.5–

7.5 cm. lata, coriacea, utrinque glabra, laevia, costa supra prominula subtus subprominente, nervis lateralibus numerosis parallelis crebris, nervis marginalibus duobus, interiore multoties arcuato nervis lateralibus conjuncto, exteriore margini perpropinquo; petiolus 3.5–5 cm. longus, supra canaliculatus, glaber; stipulae ovatae, acutae, extra brevissime pubescentes, alis marginalibus angustis glabris exceptis. RECEPTACULA subsessilia, solitaria vel gemina, ellipsoidea, 10–12 mm. longa, 7–8 mm. diametro, praesertim inferne brevissime pubescentia, aurantiaca, lenticellis viridibus notata, ostiolo bracteis tribus imbricatis obtusissimis annulo prominente castaneo-brunneo circumdato, bracteis basalibus ad annulum sinuatum reductis; pedunculus brevis, 1–4 mm. longus. FLORES ♂ pedunculati, pedunculo 0.5–0.8 mm. longo, perianthii segmentis 4 lanceolato-ovatis basi coalitis; stamen 1, filamento 1 mm. longo. FLORES ♀ cecidiophori sessiles vel breviter pedicellati, perianthii segmentis 3 raro 4 liberis lanceolatis acuminatis 1.5 mm. longis: ovarium globoso-ellipsoideum vel globoso-ovoideum, stylo terminali vel sublaterali stigmate lineari vel lineari-clavato 0.7–0.8 mm. longo coronato. FLORES ♀ non visi.

Sogeri, foothill forests, alt. 500 m., no. 641, Nov. 16, 1925.

This species is very similar to *F. garciniaefolia* Miq. from Timor, which however, has much larger receptacles. This is placed in sect. Urostigma. *F. rhizophoraephylla* King, a Papuan species, which has somewhat similar foliage, has prismatic ovaries and has been placed in sect. Eusyce. Fertile female flowers were not found in the present species, but as in some species belonging to the section Urostigma they are very few in number it is possible that *F. clusiaefolia* belongs to that section.

Ficus ihuensis, sp. nov.

Arbor parva, ramuli teretes, laeves vel leviter rugulosi, juventute atro-brunnei, deinde pallide brunnei, glaberrimi. FOLIA breviter petiolata, elliptico-lanceolata vel oblanceolata, apice breviter obtuse acuminata, basi cuneata, 6–12 cm. longa, 2–4 cm. lata, subcoriacea, laevia, nitida, discoloria, utrinque glabra, costa subtus subprominente, nervis lateralibus utrinsecus 6–9 e costa angulo 60–70° exeuntibus prope marginem arcuatim conjunctis utrinque prominulis, rete venularum subtus distincto; petiolus supra canaliculatus, 6–10 mm. longus, glaber, atro-brunneus; stipulae anguste lanceolatae, acuminatae, 7–10 mm. longae, glabrae. RECEPTACULA pedunculata, axillaria, solitaria, globosa vel pyriformi-globosa, 4–6 mm. longa, 3–5 mm. lata, tuberculato-rugulosa, glabra, viridia siccitate atro-brunnea, umbilico prominente, ostioli bracteis distinctis siccitate flavo-brunneis; pedunculus gracilis, 6–7 mm. longus, bracteis 2–4 minutis sparsis instructus. FLORES ♀ juveniles sessiles vel pedicellati, perianthii segmentis 3–4 ± coalitis; ovarium subglobosum, imperfecte evolutum, stylo infra-apicali, stigmate lineari vel subfiliformi bifido 0.7 mm. longo. FLORES ♂ et ♀ cecidiophori non visi.

Ihu, Vailala River, rain forests, no. 941, Feb. 12, 1926.

This resembles somewhat *F. pubinervis* Bl. in general facies, but that species belongs to sect. Urostigma in which this species cannot be placed. In the absence of the male-gall receptacles it is difficult to assign *F. ihuensis* to any of the sections of the genus.

Ficus xanthoxyla, sp. nov.

Arbor, circiter 9 m. alta; ramuli teretes, rugulosi, juventute adpresse pilosi, brunnei, deinde glabri, grisei, cicatricibus annularibus stipularum delapsarum notati, internodiis brevibus sed raro usque ad 3.5 cm. longis. FOLIA petiolata, elliptica vel lanceolato-elliptica, apice brevissime acuminata, obtusa, basi cuneata, 5–10 cm. longa, 2–5.5 cm. lata, chartacea vel subcoriacea, juventute utrinque praesertim subtus nervis marginibusque longiuscule adpresse pilosa, demum glabra, costa supra leviter impressa subtus prominente, nervis lateralibus utrinsecus 7–9 e costa angulo 60° exeuntibus leviter curvatis versus marginem arcuatim conjunctis, rete venularum tenuissimo distinctissimo; petiolus supra canaliculatus, 1–2.5 cm. longus, primo adpresse pilosus, demum glaber; stipulae anguste lanceolatae, acuminatae, curvatae, 8–12 mm. longae, extra longiuscule adpresse fulvo-pilosae. RECEPTACULA breviter pedunculata, axillaria, gemina vel solitaria, subglobosa, 8–10 mm. diametro, glabra, ostioli bracteis prominulis; pedunculus 2–4 mm. longus, glaber, versus apicem bracteis duabus parvis instructus. FLORES ♀ sessilia vel usque ad 2 mm. longe pedicellata, pilis setiformibus interspersis, perianthii segmentis 3 liberis spathulatis ungue angusto 1–2 mm. longis 0.7 mm. latis; achenium lateraliter compressum vel plano-convexum, secus marginem superiorem sulco distincto sed haud profunde impresso instructum, epicarpio tenui rubescente, stylo infra-apicali, stigmate obclavato compresso. FLORES ♂ et ♀ cecidiophori non visi.

Ihu, Vailala River, in rain forests, no. 1019, Febr. 20, 1926.

In general appearance this species is very similar to *F. Nugentii* Domin from Queensland, which however is a climber. As there are no male flowers it is impossible to say whether the species belongs to sect. Eusyce or sect. Sycidium. The presence of setae on the inside of the receptacle suggests that *F. xanthoxyla* may be related to *F. laevis* Bl. and *F. obtusa* Hassk. which are close relatives of *F. Nugentii* and which also possess this character.

Herbarium, Royal Botanic Gardens, Kew
May, 1929

TWO NEW SPECIES OF CARPINUS FROM SZECHUAN

H. H. HU

Carpinus Fangiana, spec. nov.

Arbor parva, 5–8 m. alta; ramuli graciles, brunneo-purpurei, lenticellati. Gemmae parvae, globosae, obtusae 1.5–2.5 mm. diam., perulis

late ovatis obtusis ciliatis nitidis fuscis. Folia oblonga, elliptico-oblonga vel oblongo-lanceolata, 6–18 cm. longa et 2.5–7 cm. lata, longe acuminata, oblique cordata, inaequaliter duplicato-serrata, supra intense viridia et glabra, subtus pallidiora, pilis longis adpressis ad venas et densius ad costam vestita, venis utrinque 24–28; petioli glabri, 6–16 mm. longi. Inflorescentia fructifera cylindrica, ad 21 cm. longa, pedunculo 3 cm. longo suffulta; bracteae papyraceae, imbricatae, 18 mm. longae et 9 mm. latae, planae, oblique late ovatae, ad apicem et ad partem inferiorem marginis interioris remote serratae, lobo basali destitutae, venis primariis 5 distantibus, tenuiter reticulatae, basi extus pilis sericeis barbatae; nuculae maturae non visae.

Small tree 5–8 m. high; branchlets slender, brownish-purple, lenticellate; bud small, globose, obtuse, 1.5–2.5 mm. in diameter, scales broad ovate, obtuse, margin ciliate, shining brown; leaves oblong, elliptic-oblong or oblong-lanceolate, long-acuminate, obliquely cordate, irregularly and doubly serrate, 6–18 cm. long, 2.5–7 cm. broad, dark green and glabrous above, paler and with appressed long hairs along the veins and more so along the midrib beneath, veins 24–28 pairs; petiole glabrous, 6–16 mm. long; fruiting ament cylindric to 21 cm. long, peduncle 3 cm. long; bracts papery, imbricate, flat, obliquely broad-ovate, remotely serrate at apex and along the lower portion of inner margin, without a basal lobe, bearded on the outside at base with silky hairs, delicately reticulate, with 5 distant primary veins, 18 mm. long, 9 mm. broad; mature nutlet unknown.

Allied to *C. cordata* Blume, differing in the much longer fruiting ament and thin papery bracts delicately veined and without basal lobe.

SZECHUAN: Nanchuan Hsien, in thickets, 1500–1800 m., *W. P. Fang*, no. 1351 (type), no. 1352, June 1, 1928.

Carpinus Wilsoniana, spec. nov.

Arbor parva, 15 m. alta, trunco 30 cm. diam., cortice laevi brunneo; ramuli intense fusci, lenticellati. Gemmae magnae, ovoideo-lanceolatae, ad 1 cm. longae, acutae, perulis late ovatis obtusis vel emarginatis ciliatis pallide brunneis. Folia oblonga, 7–17 cm. longa et 4–7.5 cm. lata, acuminata, basi leviter cordata vel late cuneata, irregulariter duplicato-serrata, supra intense viridia et glabra, subtus pallidiora et pilis adpressis ad venas et densius ad costam instructa; petioli 12 mm. longi. Inflorescentia anguste cylindrica, ad 30 cm. longa, basin versus attenuata, pedunculo 5 cm. longo suffulta; bracteae membranaceae, imbricatae, concavae, oblique elliptico-lanceolatae, utrinque acutae, ad apicem et in parte inferiore marginis exterioris remote serrulatae, parte parva marginis interioris basi inflexa et nuculam partim amplectente, sed non distincte lobatae, venis primariis 5 satis congestis, basi extus pilis sericeis barbata; nuculae ellipsoideo-oblongae, 3.5 mm. longae, glabrae, levissime costatae.

Small tree, 15 m. high 30 cm. in diameter, bark smooth, brown; branchlets dark brown, conspicuously lenticelled; buds large, ovate-lanceolate, acute, to 1 cm. long, scales broad-ovate, obtuse to emarginate at apex, margin ciliate, light brown; leaves oblong, 7–17 cm. long 4–7.5 cm. broad, acuminate, slightly cordate to subcuneate at base, irregularly and doubly serrate, dark green and glabrous above, paler and with long appresed hairs along the veins and more so along the midrib beneath; petiole 12 mm. long. Fruiting ament narrow-cylindric, to 30 cm. long, tapering toward the base, peduncle 5 cm. long; bracts thin, membranaceous, imbricate, concave, obliquely elliptic-lanceolate, acute at both ends, remotely serrulate at apex and along the lower portion of outer margin, bearded on the outside at base with silky hairs, with a small portion of inner margin folding in and embracing the nutlet, not distinctly lobed, primary veins 5, rather close; nutlet oblong, 3.5 mm. long.

Allied to *C. cordata* Blume, differing in much longer fruiting ament and elliptic-lanceolate bracts without basal lobe.

SZECHUAN: Mt. Omei, in thickets, 1675–1800 m., *W. P. Fang*, no. 2685 (type), Aug. 9, 1928.

This species is named in honor of Mr. E. H. Wilson, Keeper of Arnold Arboretum, whose intensive and extensive exploration in western China marked an epoch of discovery in the history of Chinese botany.

Fan Memorial Institute of Biology, Peking

April, 1929

CULTURES OF PUCCINIASTRUM AMERICANUM (FARLOW) ARTHUR AND P. ARCTICUM (LAGERHEIM) TRANZSCHEL

G. D. DARKER

INTRODUCTION

Two species of Rubus rusts, *Pucciniastrum americanum* (Farlow) Arthur and *Pucciniastrum arcticum* (Lagerheim) Tranzschel, have been distinguished in North America. As these species had not been associated with aecial forms experiments were undertaken to establish their connections with alternate hosts. Field associations of *P. americanum* with *Peridermium ingenuum* Arthur finally furnished the clue which led to the solution of the problem. Successful infections of *Rubus idaeus* var. *strigosus* with aeciospores of *P. ingenuum* established the connection of this rare spruce rust with *P. americanum*. Later experiments with teliosporic material on Rubus as inoculum confirmed this relationship. Other cultures established as the alternate stage of *P. arcticum* a form of *P. ingenuum* indistinguishable from that produced by *P. americanum*. As a verification of these experiments aeciospores from cultures of both species were inoculated back on suspected uredinial

hosts. Infection took place only on the hosts from which the teliosporic inoculum originated. Thus, also, by cultural methods Arthur's (1920) views concerning the separate identity of *P. arcticum* and *P. americanum* were substantiated.

HISTORICAL

Pucciniastrum arcticum (Lagerheim) Tranzschel was first described by Lagerheim (1889) as *Uredo arcticus* Lagerheim. The type material was on the host *Rubus arcticus* collected near Lulea, Sweden. Tranzschel (1895) described the teliosporic stage from Russia. In North America its distribution ranges according to Arthur (1907, 1925) from Alaska to New Brunswick and north-western Connecticut. Its hosts in North America are *Rubus stellatus*, *R. acaulis*, *R. Chamaemorus* and *R. triflorus*.

Pucciniastrum americanum (Farlow) Arthur, with a somewhat more southern range than *P. arcticum*, has been reported (Dodge 1923, Arthur 1925) on a number of Rubus hosts, *Rubus idaeus* var. *strigosus* being apparently most commonly collected. *P. americanum* was first described by Farlow (1908) as *P. arcticum* (Lagerh.) Tranz. var. *americanum* Farlow. The chief point of difference between the variety and the species *arcticum* was recognized in the form of the peridium. Clinton (1911) reported *P. arcticum* var. *americanum* on cultivated raspberries, and in the same paper, basing his statements upon hosts and parasite associations observed by Blakeslee (Clinton 1908), suggested *Peridermium balsameum* on Balsam Fir as the alternate stage. Fraser (1911) also reported field observations which pointed to Pucciniastrum on *R. idaeus* var. *aculeatissimus* as the alternate stage of *P. balsameum*, but later (1912) he stated that this connection did not seem probable. Arthur (1920) raised the name *americanum* to specific rank. This change was questioned by Davis (1921) who pointed out that the differences might be due to the hosts themselves rather than to specific differences in the parasites. Later, however, Davis (1922) cited the work of C. W. Bennett of the Department of Plant Pathology of the University of Wisconsin in which experiments were performed which indicated that *P. americanum* and *P. arcticum* were distinct species. Bennett found that urediniospores from *R. triflorus* failed to infect *R. strigosus* and *R. occidentalis* while spores from *R. strigosus* infected that host and also *R. occidentalis*. Dodge (1923) noted the occurrence of *P. americanum* on canes of Rubus and suggested that the necessity for an alternate stage might therefore be obviated in some localities. He believed that certain variations in the size and form of the sori indicated that *P. arcticum* and *P. americanum* were not distinct species.

Aecidium ingenuum Arthur was based by Arthur (1919) upon a collection of this rust on *Picea canadensis* made by Orton in 1917 at Walden, Vt. Arthur also recorded as co-type two gatherings made in Wisconsin in 1913 and 1914 by J. J. Davis. Davis (1922) listed these collections

under the name *Aecidium ingenuum* but pointed out that the aecium in this species was of the type which he referred to the genus *Peridermium* in his provisional list (1914) of the parasitic fungi in Wisconsin. Arthur (1924) redescribed the species under the name *Peridermium ingenuum* Arthur and extended the geographical range to include South Dakota. In this paper mention was made by Arthur of an earlier use of the name *P. ingenuum* Arth. as applied to the same species by Rhoads, Hedgcock, Bethel and Hartley (1918). No description of the species was made by Rhoads and others but a quotation was published from Arthur's (1919) paper which was at that time still in manuscript. In a bibliographical error, however, an earlier paper by Arthur and Kern was cited as the source of the quotation. Arthur (1919) stated that *P. ingenuum* belonged doubtless to a species of Pucciniastrum.

CULTURES

The cultures performed with *Pucciniastrum americanum* and *P. arcticum* fall into five main divisions as follows: *P. americanum* inoculations—(1) cultures with field material of *Peridermium ingenuum* of unknown telial origin as inoculum, (2) cultures with teliosporic inoculum, (3) cultures with authentic aecial material; *P. arcticum* inoculations—(4) cultures with teliosporic inoculum and (5) cultures with authentic aecial material.

CULTURES OF PUCCINIASTRUM AMERICANUM (FARLOW) ARTHUR

Cultures with Peridermium ingenuum Arthur

Peridermium ingenuum Arthur on *Picea canadensis* (=*P. glauca*) was collected in June 1923 by Dr. J. H. Faull at Otter, Ontario. Field associations seemed to point to *Rubus idaeus* var. *strigosus* as the alternate host.

On July 5, 1927 *Peridermium ingenuum* was found on Bear Island, Lake Timagami, Ontario, producing an abundant though scattered infection on a single isolated tree of *Picea canadensis*. This tree had been cut off about four feet above the ground and several branches were struggling for the leadership, making a low compact growth very favorable to rust infection. It was situated in a small clearing in a balsam fir grove and immediately surrounding it and in many cases intertwined with its lower branches were numerous canes of *Rubus idaeus* var. *strigosus*. About one hundred yards away *Pucciniastrum americanum* had been observed on Rubus during the summers of 1924, 1925 and 1926. Accordingly the alternate host was at once suggested.

Free-hand sections of infected spruce needles collected at Lake Timagami, Ontario, revealed subcuticular pycnia characteristic of *Peridermium ingenuum*.

Inoculations

Aeciospores of *Peridermium ingenuum* were scraped from the spruce needles into a few drops of water in a watch glass. At suitable places

in the forest, isolated from previously known infections of *Pucciniastrum americanum*, specimens of *Rubus idaeus* var. *strigosus*, *R. triflorus* and *Pyrola elliptica* were selected for inoculation. The inoculum was then smeared with a camel's hair brush on leaves of these plants, especially on their lower surfaces. The inoculated portions were marked with metal tags and enclosed for several days within celluloid cylinders (Hubert 1916) which were plugged at the ends with wet sphagnum.

Another type of inoculation was tried out but with less success. Leaflets of *Rubus idaeus* var. *strigosus* and *R. triflorus* were placed in petri dishes on filter paper moistened with water. These leaflets, except for controls, were inoculated with spores of *Peridermium ingenuum*.

Infections

After an incubation period ranging from 7 to 11 days minute uredinia appeared in the field experiments on *Rubus idaeus* var. *strigosus* (See Table I) and in several cases infection was very heavy. In the case of inoculation of leaflets in petri dishes a slight infection of *R. idaeus* var. *strigosus* was obtained on 3 out of 8 leaflets inoculated (See Table IV).

Free-hand sections of the rusted leaves of *Rubus idaeus* var. *strigosus* established the identity of the infections as *Pucciniastrum americanum* (Farl.) Arth. The sections showed numerous small uredinia, each of which exhibited an extraordinarily elongated peridium surmounted by a corona of spiny apical cells. Urediniospores from infections produced in Experiment 405 (See Table I) measured 9–14 × 17–22 μ which is in fairly close agreement with measurements recorded by Arthur (1925).

A heavy natural infection of *Pucciniastrum americanum* developed on leaves of *Rubus idaeus* var. *strigosus* in the vicinity of the Spruce tree which carried *Peridermium ingenuum* earlier in the season.

TABLE I

Peridermium ingenuum Arth. on *Picea canadensis*

Host inoculated—*Rubus idaeus* var. *strigosus*

Experiment number	Inoculum collected	Date of inoculation	Cylinder on branch (days)	First appearance of uredinia (days)	Uredinia mature (days)	Date harvested	No. of leaves inoculated	No. of pinnae inoculated	No. of pinnae infected	Percentage of pinnae infected	Approximate no. of uredinia
405	5.7.27	5.7.27	5	7	8	15.7.27	3	9	8	89	1350
406	5.7.27	5.7.27	9	11	11	28.7.27	3	15	8	53	130
409	5.7.27	5.7.27	6	9	10	19.7.27	3	9	8	89	630
410	5.7.27	5.7.27	6	8	9	19.7.27	3	9	9	100	1300
437	5.7.27	5.7.27	9	10	10	19.7.27	2	6	6	100	2200
438	5.7.27	5.7.27	9	9	11	19.7.27	2	7	6	86	470
439	5.7.27	5.7.27	9	10	10	19.7.27	3	9	7	78	2190
460	5.7.27	7.7.27	5	7	8	26.7.27	2	6	6	100	650
461	5.7.27	7.7.27	5	7	8	26.7.27	1	3	3	100	1720

TABLE II

Peridermium ingenuum Arth. on *Picea canadensis*

Host inoculated—*Rubus triflorus*

Experiment number	Inoculum collected	Date of inoculation	Cylinder on branch (days)	First appearance of uredinia (days)	Uredinia mature (days)	Date harvested	No. of leaves inoculated	No. of pinnae inoculated	No. of pinnae infected	Percentage of pinnae infected	Approximate no. of uredinia
407	5.7.27	5.7.27	6	—	—	7.8.27	—	—	—	—	—
408	5.7.27	5.7.27	6	—	—	7.8.27	—	—	—	—	—
459	5.7.27	7.7.27	5	—	—	29.7.27	—	—	—	—	—

TABLE III

Peridermium ingenuum Arth. on *Picea canadensis*

Host inoculated—*Pyrola elliptica*

Experiment number	Inoculum collected	Date of inoculation	Cylinder on branch (days)	First appearance of uredinia (days)	Uredinia mature (days)	Date harvested	No. of leaves inoculated	No. of leaves infected	Percentage of leaves infected	Approximate no. of uredinia
456	5.7.27	7.7.27	5	—	—	29.7.27	—	—	—	—
457	5.7.27	7.7.27	5	—	—	29.7.27	—	—	—	—
458	5.7.27	7.7.27	5	—	—	29.7.27	—	—	—	—

TABLE IV

Peridermium ingenuum Arth. on *Picea canadensis*

Host inoculated (in petri dish)—*Rubus idaeus* var. *strigosus*

Experiment number	Inoculum collected	Date of inoculation	Appearance of uredinia
440	5.7.27	6.7.27	—
441	5.7.27	6.7.27	14.7.27
442	5.7.27	6.7.27	14.7.27
443	5.7.27	6.7.27	—
444	5.7.27	6.7.27	14.7.27
445	5.7.27	6.7.27	—
446	5.7.27	6.7.27	—
447	5.7.27	6.7.27	—
448	5.7.27	6.7.27	—

TABLE V

Peridermium ingenuum Arth. on *Picea canadensis*

Host inoculated (in petri dish)—*Rubus triflorus*

Experiment number	Inoculum collected	Date of inoculation	Appearance of uredinia
449	5.7.27	6.7.27	—
450	5.7.27	6.7.27	—
451	5.7.27	6.7.27	—
452	5.7.27	6.7.27	—
453	5.7.27	6.7.27	—
454	5.7.27	6.7.27	—
455	5.7.27	6.7.27	—

Cultures with Teliosporic inoculum

Pucciniastrum americanum was found in several small patches of *Rubus idaeus* var. *strigosus* on Bear Island, Lake Timagami, Ontario, during the years 1924 to 1928. The rust was identified by its subepidermal teliospores and also by its elongated peridium which is surrounded by a crown of spiny apical cells.

Care of the inoculum

Leaves of *Rubus idaeus* var. *strigosus* bearing teliospores were overwintered in cheese-cloth bags which had been dipped into hot paraffin. A number of these bags were tied, at a distance of a few inches above the ground, to stakes which were set out in shady thickets on Bear Island, Lake Timagami. Other material, overwintered at the Department of Botany, University of Toronto, was kept in a refrigerator until cold weather arrived. Every three or four weeks the inside of the box in which the inoculum was stored was moistened with water. On the arrival of cold weather the material was taken to a shady spot in the open where it was tied to the inside of a box in such a manner that when the box was inverted the material was suspended at a distance of a few inches above the soil. On the return of warm weather in the spring the inoculum was again placed in the refrigerator.

Just before the opening of the Spruce buds in the spring the inoculum was placed in petri dishes lined with moist filter paper and as soon as basidia began to appear the inoculation experiments were set up. Sometimes inoculum was used which did not show any signs of germination. This was considered necessary on account of the limited amount of inoculum bearing teliospores and also because of the difficulties experienced in the observation of the basidia which were hidden by the hairs on the lower surfaces of the Rubus leaves.

A few observations of germinating teliospores of *Pucciniastrum americanum* showed colorless basidia about 5 μ in thickness and about 80 μ in length. Sterigmata measured 5–8 μ in length and basidiospores were about 5.5 μ in diameter.

Technique of inoculation

In some inoculation experiments the inoculum was merely placed above the host needles which were then enclosed in a celluloid tube plugged at the ends with moist sphagnum or cotton. A more economical manner of distribution of the inoculum was used when the formation of basidia was observed. In this case the inoculum was placed on a small rectangle of moistened blotting paper and a piece of fine wire window screening was placed above it. The blotter and screening were then tied lightly together and the whole was inverted carefully over the host needles inside a celluloid tube in such a way that the basidiospores could fall through the meshes of the screening.

INOCULATIONS

The following inoculations of *Abies balsamea*, *Tsuga canadensis*, *Picea canadensis* and *P. mariana* were made in order to test out these conifers as possible alternate hosts of *Pucciniastrum americanum*.

Year	Host	No. of inoculations
1926	Abies balsamea	14
	Tsuga canadensis	6
1927	Abies balsamea	2
	Tsuga canadensis	2
	Picea canadensis	12
	Picea mariana	7
1928	Tsuga canadensis	2
	Picea canadensis	30
	Picea mariana	13

INFECTIONS

Of the experiments listed above only certain of the 1928 inoculations on *Picea canadensis* gave positive results. Failure to obtain similar infection on *P. canadensis* in 1927 was very probably due to the fact that the Spruce inoculations in that year were performed too late in the season. The fact that peridermia are often mature on *P. canadensis* before the young leaves of *P. mariana* have unfolded suggests a reason for failure to infect the latter host. Additional inoculations should be performed on *P. mariana* under more favorable conditions.

As shown by Table VI *Picea canadensis* proved to be susceptible to infection by the rust and after an incubation period of 9–14 days pycnia appeared on the spruce needles. These were followed at the end of 13–17 days from the date of inoculation by peridermia.

Pycnia and peridermia produced on *Picea canadensis* by infections with *Pucciniastrum americanum* answered fairly closely to descriptions of Arthur's *Peridermium ingenuum*. Pycnospores from Experiment 31 measured 3.9–5.9 × 2.0–2.4 μ. Aeciospores from Experiment 39 were 20–28 × 17–21 μ and the aecial peridial cells from the same experiment measured 32–44 × 17–21 × 13–16 μ, the last measurement representing their thickness. Measurements were made of the lengths of uniformly infected portions of needles and the peridermia along one of the stomatal areas in each of these portions were counted. From these counts the numbers of peridermia per centimetre of leaf length were calculated for a number of leaf surfaces. An average of 34 counts from a number of experiments with *P. americanum* gave 22 peridermia per cm. of leaf face. Occasionally peridermia are borne along all four of the leaf faces of the spruce needle.

INOCULATIONS WITH AECIOSPORES

In order to verify the experiments carried out with *Peridermium ingenuum* in 1927 aeciospores of *Pucciniastrum americanum* from the foregoing experiments were employed to inoculate *Rubus idaeus* var.

strigosus, *R. triflorus* and *Agrimonia mollis*. As shown in Tables VII, VIII and IX an extremely heavy infection was obtained on *R. idaeus* var. *strigosus* while *R. triflorus* and *A. mollis* remained free from infection.

TABLE VI

Pucciniastrum americanum (Farl.) Arth. on *Rubus idaeus* var. *strigosus*

Host inoculated—*Picea canadensis*

Experiment number	Inoculum placed in moist chamber	Date of inoculation	Cylinder on branch (days)	First appearance of pycnia (days)	First appearance of peridermia (days)	First breaking of peridermia (days)	Date harvested	No. of 1928 needles in inoculation tube	No. of needles bearing peridermia	No. of needles bearing pycnia only	Percentage of infection
24	7.6.28	12.6.28	6	12	16	18	29.7.28	248	1	1	1
25	7.6.28	12.6.28	6	10	14	17	3.7.28	225	11	2	6
26	7.6.28	12.6.28	6	—	—	—	29.7.28	—	—	—	—
27	7.6.28	12.6.28	5	11	?	?	19.7.28	306	1	1	1
28	7.6.28	12.6.28	5	11	—	—	19.7.28	459	0	4	1
29	7.6.28	12.6.28	5	—	—	—	19.7.28	—	—	—	—
30	7.6.28	12.6.28	5	11	?	?	19.7.28	454	2	1	1
31	7.6.28	12.6.28	5	10	13	16	1.7.28	524	41	5	9
32	7.6.28	12.6.28	5	9	14	18	1.7.28	610	3	0	0
35	7.6.28	12.6.28	5	14	—	—	26.7.28	170	0	2	1
36	7.6.28	12.6.28	5	—	—	—	26.7.28	—	—	—	—
37	7.6.28	12.6.28	5	11	17	19	3.7.28	352	12	4	5
38	7.6.28	12.6.28	5	12	17	20	3.7.28	411	4	5	2
39	7.6.28	12.6.28	5	9	13	18	3.7.28	482	27	2	6
40	7.6.28	12.6.28	5	13	15	18	3.7.28	433	5	0	1
41	7.6.28	12.6.28	5	9	13	15	3.7.28	471	16	1	4
42	7.6.28	12.6.28	5	10	14	18	3.7.28	354	7	2	3
43	7.6.28	12.6.28	5	13	—	—	26.7.28	162	0	2	1
53	7.6.28	13.6.28	1	10	15	20	10.7.28	47	3	0	6
54	7.6.28	13.6.28	1	10	14	18	10.8.28	61	2	5	11
55	7.6.28	13.6.28	1	12	14	18	10.8.28	52	1	0	2
56	7.6.28	13.6.28	1	12	—	—	10.8.28	30	0	1	3
57	7.6.28	13.6.28	1	—	—	—	10.8.28	32	—	—	—
58	7.6.28	13.6.28	1	—	—	—	10.8.28	57	—	—	—
59	7.6.28	13.6.28	1	12	—	—	10.8.28	38	0	2	5
60	7.6.28	13.6.28	1	?	?	?	10.8.28	47	2	0	4
137	18.6.28	23.6.28	5	—	—	—	29.7.28	—	—	—	—
138	18.6.28	23.6.28	5	—	—	—	29.7.28	—	—	—	—
139	18.6.28	23.6.28	5	—	—	—	29.7.28	—	—	—	—
147	18.6.28	23.6.28	5	—	—	—	10.8.28	—	—	—	—

TABLE VII

Pucciniastrum americanum (Farl.) Arth. on *Picea canadensis*

Host inoculated—*Rubus idaeus* var. *strigosus*

Experiment number	1928 inoculations used as sources of inoculum	Inoculum collected	Date of inoculation	Cylinder on branch (days)	First appearance of uredinia (days)	Uredinia mature (days)	Date harvested	No. of leaves inoculated	No. of pinnae inoculated	No. of pinnae infected	Percentage of pinnae infected	Approximate no. of uredinia
200	31, 32	1.7.28	2.7.28	6	8	9	13.7.28	2	6	6	100	4300
205	25, 37	3.7.28	4.7.28	6	7	8	13.7.28	2	6	6	100	5000
206	39, 40, 41	3.7.28	4.7.28	6	7	8	13.7.28	2	6	6	100	4300

TABLE VIII

Puccinia strum americanum (Farl.) Arth. on *Picea canadensis*

Host inoculated—*Rubus triflorus*

Experiment number	1928 inoculations used as sources of inoculum	Inoculum collected	Date of inoculation	Cylinder on branch (days)	First appearance of uredinia (days)	Uredinia mature (days)	Date harvested	No. of leaves inoculated	No. of pinnae inoculated	No. of pinnae infected	Percentage of pinnae infected	Approximate no. of uredinia
201	31, 32	1.7.28	2.7.28	6	—	—	2.8.28	—	—	—	—	—

TABLE IX

Puccinia strum americanum (Farl.) Arth. on *Picea canadensis*

Host inoculated—*Agrimonia mollis*

Experiment number	1928 inoculations used as sources of inoculum	Inoculum collected	Date of inoculation	Cylinder on branch (days)	First appearance of uredinia (days)	Uredinia mature (days)	Date harvested	No. of leaves inoculated	No. of pinnae inoculated	No. of pinnae infected	Percentage of pinnae infected	Approximate no. of uredinia
207	25, 37, 39, 40,	3.7.28	4.7.28	7	—	—	17.8.28	—	—	—	—	—
208	41	3.7.28	4.7.28	7	—	—	17.8.28	—	—	—	—	—

CULTURES OF PUCCINIASTRUM ARCTICUM (LAGERHEIM) TRANZSCHEL

Cultures with teliosporic inoculum

Puccinia strum arcticum found on *Rubus triflorus* on Bear Island, Lake Timagami, Ontario, during the seasons of 1925, 1926 and 1927 was overwintered and used to carry out inoculations as described under *P. americanum* cultures above. The following species of conifers were used as hosts for inoculation: *Abies balsamea, Tsuga canadensis, Taxus canadensis, Picea mariana* and *Picea canadensis.*

Year	Host	No. of inoculations
1926	Abies balsamea	14
	Taxus canadensis	1
	Tsuga canadensis	14
1927	Abies balsamea	3
	Tsuga canadensis	2
	Picea canadensis	3
	Picea mariana	4
1928	Tsuga canadensis	4
	Picea canadensis	15
	Picea mariana	38

Infections

Infection was obtained with *Puccinia strum arcticum* on *Picea canadensis* only (See Table X). On this host pycnia appeared in 10 to 11 days followed by peridermia in 15 to 18 days. Although infection was not heavy it was at least sufficiently abundant that the connection of

TABLE X

Pucciniastrum arcticum (Lagerh.) Tranz. on *Rubus triflorus*

Host inoculated—*Picea canadensis*

Experiment number	Inoculum placed in moist chamber	Date of inoculation	Cylinder on branch (days)	First appearance of pycnia (days)	First appearance of peridermia (days)	First breaking of peridermia (days)	Date harvested	No. of 1928 needles in inoculation tube	No. of needles bearing peridermia	No. of needles bearing pycnia only	Percentage of infection
63	7.6.28	13.6.28	5	11	15	?	15.7.28	443	2	1	1
64	7.6.28	13.6.28	5	—	—	—	15.7.28	—	—	—	—
72	7.6.28	14.6.28	5	—	—	—	13.8.28	—	—	—	—
73	7.6.28	14.6.28	5	—	—	—	13.8.28	—	—	—	—
74	7.6.28	14.6.28	5	10	18	20	8.7.28	392	18	18	9
75	7.6.28	14.6.28	5	?	?	21	8.7.28	460	1	0	0
76	7.6.28	14.6.28	5	11	18	20	8.7.28	427	6	0	1
77	7.6.28	14.6.28	5	11	18	20	10.7.28	534	2	1	1
78	7.6.28	14.6.28	5	—	—	—	13.8.28	—	—	—	—
79	7.6.28	14.6.28	5	—	—	—	13.8.28	—	—	—	—
80	7.6.28	14.6.28	5	?	—	—	13.8.28	270	0	1	0
81	7.6.28	14.6.28	5	10	16	18	5.7.28	505	17	1	6
82	7.6.28	14.6.28	5	?	?	?	7.7.28	134	3	1	3
83	7.6.28	14.6.28	5	—	—	—	13.8.28	—	—	—	—
84	7.6.28	14.6.28	5	—	—	—	13.8.28	—	—	—	—

TABLE XI

Pucciniastrum arcticum (Lagerh.) Tranz. on *Picea canadensis*

Host inoculated—*Rubus triflorus*

Experiment number	1928 inoculations used as sources of inoculum	Inoculum collected	Date of inoculation	Cylinder on branch (days)	First appearance of uredinia (days)	Uredinia mature (days)	Date harvested	No. of leaves inoculated	No. of pinnae inoculated	No. of pinnae infected	Percentage of pinnae infected	Approximate no. of uredinia
209	81	5.7.28	5.7.28	6	15	17	2.8.28	2	6	6	100	1310
210	81	5.7.28	5.7.28	6	17	19	2.8.28	1	3	3	100	730

TABLE XII

Pucciniastrum arcticum (Lagerh.) Tranz. on *Picea canadensis*

Host inoculated—*Rubus idaeus* var. *strigosus*

Experiment number	1928 inoculations used as sources of inoculum	Inoculum collected	Date of inoculation	Cylinder on branch (days)	First appearance of uredinia (days)	Uredinia mature (days)	Date harvested	No. of leaves inoculated	No. of pinnae inoculated	No. of pinnae infected	Percentage of pinnae infected	Approximate no. of uredinia
211	81	5.7.28	5.7.28	6	—	—	2.8.28	1	5	—	—	—

the peridermium produced on the spruce needles with *P. arcticum* was considered to have been established.

Field measurements from fresh material of *Pucciniastrum arcticum* on *Picea canadensis* were as follows: pycnospores—3.9–4.7 × 1.3–1.6 μ, aeciospores—17–25 × 14–18 μ and aecial peridial cells—30–47 (length)

× 14–21 μ (breadth). An average of 19 peridermia per cm. along a single leaf face was obtained for three estimates. From these measurements it is obvious that the aecial stage of *P. arcticum* on *P. canadensis* is very closely related to the aecial stage of *P. americanum* and indeed in the field the two species on *P. canadensis* are indistinguishable. Microscopically they may show specific differences but at present the name *Peridermium ingenuum* undoubtedly covers the aecial stages of both species.

Cultures with aecial inoculum

Aeciospores of *Pucciniastrum arcticum* from Experiment 81 were cultured on leaves of *Rubus triflorus* and *R. idaeus* var. *strigosus*. Although only a few experiments were set up the results were in striking contrast to those performed with *P. americanum*. After an incubation period of 15 to 17 days uredinia appeared on *R. triflorus* while the single inoculated leaf of *R. idaeus* var. *strigosus* remained free from infection (See Tables XI and XII).

The writer wishes to acknowledge his indebtedness for numerous helpful suggestions during the course of these investigations to Professor J. H. Faull at whose proposal the problem was undertaken. Assistance was freely given from the Special Research Fund of the University of Toronto.

SUMMARY

Pucciniastrum americanum (Farl.) Arth. on *Rubus idaeus* var. *strigosus* has its aecial stage, *Peridermium ingenuum* Arthur (in part), on *Picea canadensis*. Successful infections were obtained in both directions.

No infection was obtained with this rust on *Abies balsamea*, *Picea mariana*, *Tsuga canadensis*, *Rubus triflorus*, *Agrimonia mollis* and *Pyrola elliptica*.

Pucciniastrum arcticum (Lagerh.) Tranz. on *Rubus triflorus* has its aecial stage, *Peridermium ingenuum* Arthur (in part), also on *Picea canadensis*. Successful infections were obtained in both directions.

No infection was obtained with *Pucciniastrum arcticum* on *Abies balsamea*, *Taxus canadensis*, *Tsuga canadensis*, *Picea mariana* and *Rubus idaeus* var. *strigosus*.

Artificial infections establish *Pucciniastrum americanum* and *P. arcticum* as distinct species.

Peridermium ingenuum is a name that has apparently designated the aecial stages of both *Pucciniastrum americanum* and *P. arcticum*.

BIBLIOGRAPHY

1. Arthur, J. C. (1907). Uredinales. North American Flora, **7**(2): 83–160.
2. ———— (1919). New species of Uredineae—XI. Bull. Torrey Bot. Club, **46**: 107–125.
3. ———— (1920). New species of Uredineae—XII. Bull. Torrey Bot. Club, **47**: 465–480.
4. ———— (1924). Uredinales. North American Flora, **7**(9): 605–668.
5. ———— (1925). Uredinales. North American Flora, **7**(10): 669–732.

6. Clinton, G. P. (1908). Heteroecious rusts of Connecticut having a peridermium for their aecial stage. Report of the Station Botanist, 1907. Conn. Agric. Exp. Station Report 1907–1908. Issued **1908**: 369–396.
7. ———— (1911). Report of the Station Botanist, 1909–1910. Conn. Agric. Exp. Station Report 1909–1910. Issued **1911**: 713–774.
8. Davis, J. J. (1914). A provisional list of the parasitic fungi of Wisconsin. Trans. Wisc. Acad. Sc., Arts and Letters, **17**: 846–984.
9. ———— (1921). (Pucciniastrum). Mycologia, **13**: 58.
10. ———— (1922). (Pucciniastrum). Mycologia, **14**: 46.
11. ———— (1922). Notes on parasitic fungi in Wisconsin VIII. Trans. Wisc. Acad. Sc., Arts and Letters **20**: 413–431.
12. Dodge, B. O. (1923). Morphology and host relations of Pucciniastrum americanum. Journ. Agric. Res. **24**: 885–894.
13. Farlow, W. G. (1908). Notes on fungi—I. Rhodora, **10**: 9–17.
14. Fraser, W. P. (1911). Cultures of some heteroecious rusts. Mycologia, **3**: 67–74.
15. ———— (1912). Cultures of heteroecious rusts. Mycologia, **4**: 175–193.
16. Hubert, E. E. (1916). Celluloid cylinders for inoculation chambers. Phytopathology, **6**: 447–450.
17. Lagerheim, G. (1889). Ueber einige neue oder bemerkenswerthe Uredineen. Hedwigia, **28**: 103–112.
18. Rhoads, A. S., G. G. Hedgcock, E. Bethel and C. Hartley (1918). Host relationships of the North American rusts, other than Gymnosporangiums, which attack conifers. Phytopathology, **8**: 309–352.
19. Tranzschel, W. von (1895). O teleitosporsack gribow, Uredo arcticus Lag., Uredo Agrimoniae D C. i Melampsora Alni Thuem. Script. Bot. Hort. Univ. Imp. Petrop. **4**: 299–302.

Arnold Arboretum Laboratory, Harvard University,
Jamaica Plain, Mass.

THE CHROMOSOMES OF SOME SPECIES OF THE GENUS PHILADELPHUS

Walter Bangham

The Mock-oranges were cultivated as garden plants in very early Southern European gardens. With the exception of *Philadelphus coronaria* L. which occurs in southeastern Europe and the Caucasus the genus is now found represented in the flora of three regions, Eastern Asia, Southeastern U. S. A. and Western North America, although it is now cultivated in most of the temperate regions.

While no fossil record of Philadelphus has been found it seems certain that the genus existed in the late eocene or in miocene times and that it was present in the flora of northern North America and Asia which at that time supported a temperate to subtropical flora. According to Berry[1] the end of the eocene period was marked by the elevation of the Rocky Mountain region with the consequent development of aridity in the Great Plains. Those features prevented the escape of other plants into the Pacific coast area as the Arctic regions again became cold and the temperate flora retreated to more southern localities.

Hydrangea, a closely allied genus and one which shows an almost identical distribution to that of Philadelphus, has left its fossil record

[1] Berry, Edward W., Tree ancestors, 1923.

in this Miocene deposit. Its flowers were found in the Mascall flora near Spokane, Washington.[1]

A separation of the species since the late eocene (a matter of several million years) should have given an ample opportunity for a change to have taken place in the number and genetic constitution of the chromosomes unless they form an extremely stable group. Many hybrid forms have originated under cultivation wherever several species have grown in close proximity.

An examination of the pollen-mother cells of about forty of the species, hybrids and varieties found in the Arnold Arboretum, which represent all the taxonomic groups and native localities of the genus, revealed no marked difference in their chromosome groups. All the species examined had a haploid chromosome count of 13 and the chromosomes seemed to be perfectly compatible in the hybrids. There was no evidence of lagging or other aberrant behavior. Counts were usually made at diakinesis as there was usually some clumping of the chromosome at the first metaphase. The anthers were smeared, fixed permanently with Nawaschin's solution, and stained with crystal violet by Newton's method.

As will be noted below, *P. maximus* is given by Rehder[2] as a cross between *P. tomentosus* of Himalayan origin and *P. pubescens* which is a native of Southeastern U. S. A. The chromosomes seem to be completely compatible in *P. maximus* which would indicate that there must have been very little change in their makeup in the millions of years that they, or their ancestors, have been separated.

The only departures from complete fertility were the hybrids *P. cymosus* "Bannière," with a semi-double flower having modified anthers but no pollen, and *P. insignis* which developed no anthers.

The chromosomes of the following forms were counted. The grouping is that of Rehder.[2]

Group 1. GORDONIANI Koehne.

P. Lewisii Pursh; Mont. to Wash. and Ore.
P. confusus Piper; Wash.
P. Gordonianus Lindl.; B. C. to Idaho and N. Calif.
P. pubescens Lois.; Tenn. to Ala. and Ark.
P. pubescens var. intectus A. H. Moore; Tenn.
P. monstrosus Rehd. (P. ? Gordonianus × pubescens).

Group 2. SERICANTHI, Rehd.

P. Magdalenae Koehne; W. China.
P. incanus Koehne; W. China.
P. subcanus Koehne; C. and W. China.
P. sericanthus Rehderianus Koehne; W. China.
P. purpurascens Rehd.; W. China.
P. Delavayi L. Henry; Yunnan.

[1] KNOWLTON, FRANK HALL, Plants of the past, 1927.
[2] REHDER, ALFRED, Manual of cultivated trees and shrubs, 1927.

Group 3. Coronarii Koehne.
P. satsumanus Miq.; Japan.
P. satsumanus var. nikoensis Rehd.
P. tomentosus Wall.; Himalayas.
P. maximus Rehd. (P. pubescens × tomentosus).
P. nepalensis Koehne; Himalayas.
P. pekinensis Rupr.; N. China to Korea.
P. Schrenkii var. Jackii Koehne; Korea, N. China.
P. coronarius L.; S. Eur., Italy to Cauc.
P. coronarius var. salicifolius Jacques.
P. Zeyheri Schrad. (P. coronarius × inodorus or grandiflorus).
P. floribundus Schrad. (P. coronarius × ? Gordonianus).
P. Falconeri Sarg. (P. coronarius × laxus).
Group 4. Speciosi Koehne.
P. laxus Schrad.; Ga.
P. inodorus L.; N. C. to Fla. and Ala.
P. splendens Rehd. (P. grandiflorus × ? Gordonianus).
P. magnificus Koehne (P. grandiflorus × pubescens).
P. floridus Beadle; N. C. to Ga.
Group 5. Microphylli Koehne.
P. Lemoinei Lemoine (P. microphyllus × coronarius).
P. polyanthus Rehd. "Favorite" (P. Lemoinei × ? insignis).
P. cymosus Rehd. (P. Lemoinei × ? grandiflorus).
P. " "Norma."
P. " "Conquete."
P. virginalis Rehd. (P. Lemoinei × ? nivalis plenus).
Group 5. Gemmati Koehne.
P. hirsutus Nutt.; N. C. and Tenn. to Ga. and Ala.
P. "Atlas" Lemoine and P. "Girandole" Lemoine are two garden hybrids of which the parents are unknown.

I wish to express the highest appreciation for the advice and assistance of Professor Karl Sax and Mr. Alfred Rehder, which they gave freely throughout this investigation.

Arnold Arboretum Laboratory
Jamaica Plain, Mass.

ORCHIDS COLLECTED BY J. F. ROCK ON THE ARNOLD ARBORETUM EXPEDITION TO NORTHWESTERN CHINA AND NORTHEASTERN TIBET

Charles Schweinfurth

Cypripedium luteum Franchet in Nouv. Arch. Mus. Hist. Nat. Paris, sér. 2, x. 88 (1887).

Southwestern Kansu: Upper Tebbu country, outskirts of spruce forest, near gulch leading to Wapaku, southern slopes of Minshan, alt. 3000 m., no. 12536, June, 1925 (flowers yellow).

Cypripedium nutans Schlechter in Meddel. Göteb. Bot. Trädgård, I. 128 (1924) (as *Cypripedilum nutans*), ex char.

SOUTHWESTERN KANSU. Upper Tebbu country: southern slopes of Minshan; along bank of mountain stream, alt. 3200 m., no. 12499, June, 1925 (flowers reddish brown, striped).

These specimens differ from the typical plant (as described) in that the ovary and upper part of the peduncle are somewhat sparingly cellular-pubescent and the lamina of the connate lateral sepals is markedly narrower than specified.

Cypripedium tibeticum King ex Hemsley in Jour. Linn. Soc. XXIX. 320 (1892).

SOUTHWESTERN KANSU. Upper Tebbu country: along banks of Kaiochowho, southern slopes of Minshan, common, alt. 3200 m., no. 12521, June, 1925.

EASTERN TIBET. Radja and Yellow River gorges: grassy northern slopes of river valley south of Radja, alt. 3200 m., no. 13989, May 25, 1926 (flowers red to purple); alpine meadows of mountains opposite Radja, alt. 3500 m., no. 14165, June, 1926.

Orchis Chusua D. Don, Prodr. Fl. Nepal. 23 (1825).

CENTRAL KANSU. Lien hoa shan: in mossy ground and spruce forests, between Taochow and Titao, alt. 3000 m., no. 12735, July 14–20, 1925 (flowers deep rich purple).

SOUTHWESTERN KANSU. T'ao River basin: on boulders of Shiaoku, at Shimen, beyond Adjuan, alt. 3000 m., no. 12833, July, 1925 (flowers rich purple); Upper Tebbu country: on mossy boulders in Abies and Picea forests, road to Pandrukikoa, alt., 3350 m., no. 13115, Aug., 1925 (flowers purplish lavender).

Orchis salina Turczaninow ex Lindley, Gen. and Sp. Orch. 259 (1835), ex char.

EASTERN TIBET. Radja and Yellow River gorges: grassy slopes opposite bank of Yellow River, alt. 3200 m., no. 13978, May 25, 1926 (flowers deep purplish red). Ba valley: alt. 3000 m., no. 14251, June, 1926 (flowers purple), swampy meadow near Saoch Rongwa villages, alt. 2900 m., no. 14356, July, 1926 (flowers deep purple).

Orchis spathulata Reichenbach f. ex Hooker f., Fl. Brit. Ind. VI. 127 (1890).

CENTRAL KANSU. Lien hoa shan: in spruce forests and mossy ground between Taochow and Titao, alt. 3000 m., no. 12713, July 12–20, 1925 (flowers purple).

This is a small form with very narrow leaves (5–9 mm. wide).

Aceratorchis tschiliensis Schlechter in Fedde Rep. Spec. Nov. Beihefte, XII. 329 (1922), ex char.

Eastern Tibet. Radja and Yellow River gorges: alpine meadows, mts. southwest of Radja; south of river, alt. 3600–3900 m., no. 14190, June, 1926 (flowers white).

The writer shares with Dr. Schlechter, the author of this genus and species, the suspicion that this plant may well be a peloric form of some species of Orchis. For if it were not for the complete absence of a spur, it would be inseparable from that genus.

It is, however, a decided error to refer *Orchis Delavayi* Schltr. (Vide Schlechter in Fedde Rep. Spec. Nov. Beihefte, xii. 330 (1922) which has a 3-lobed lip and a prominent spur, to the synonymy of this simple-lipped, spurless species.

The plant cited in this enumeration differs from the type description in its markedly larger white, not rosy, flowers.

Amitostigma monanthum (Finet) Schlechter in Fedde Rep. Spec. Nov. Beihefte, iv. 94 (1919), ex char.

Southwestern Kansu. T'ao River basin: mossy boulders and on banks of Hsiaoku stream, alt. 3000 m., no. 12622, July 6, 1925 (flowers white, spotted brownish-white).

The writer does not feel entirely satisfied with the distinctness of this genus from Orchis. However, this collection surely represents *Peristylus monanthus* Finet in Rev. Gén. Bot. xiii. 523, t. 17, figs. 1–9 (1901).

Herminium tanguticum Rolfe in Jour. Linn. Soc. xxxvi. 51 (1903), ex char.

Central Kansu. Lien hoa shan: in mossy ground and spruce forests, between Taochow and Titao, alt. 3000 m., no. 12736, July 14–20, 1925 (flowers whitish green).

The plants of this collection show racemes which are generally longer than typical.

Habenaria conopsea Bentham in Jour. Linn. Soc. xviii. 354 (1881). *Gymnadenia conopsea* R. Brown in Aiton Hort. Kew. ed. 2, v. 191 (1813).

Southwestern Kansu. T'ao River basin: ridges of Merku valley, southwest of Choni, in spruce forest, alt. 3000 m., no. 12944, July, 1925 (flowers pale pink lavender, very fragrant); Upper Tebbu country: grassy slopes beyond Pandrukika, on road to Sungpan, Drjakana, alt. 3800 m., no. 13120, Aug., 1925 (flowers reddish purple; odor of vanilla).

Habenaria cucullata (L.) Hoefft, Cat. Pl. Kursk. 56 (1826). *Gymnadenia cucullata* L. C. Richard in Mém. Mus. Paris, iv. 57 (1818).

Southwestern Kansu. Lower Tebbu country: in mossy ground and humus; open places in forests, Wantsang valley, alt. 2500 m., no. 14700, Sept. 3, 1926 (leaf dark green spotted purple; flowers lilac or pale lavender, fragrant).

Habenaria spiranthiformis Ames and Schlechter in Fedde Rep. Spec. Nov. Beihefte, IV. 52 (1919).

EASTERN TIBET. Radja and Yellow River gorges: grassy sand banks of Yellow river, southeast of Radja, alt. 3000 m., no. 14210, June, 1926 (flowers green).

This collection represents a mature form of the species.

Amesia longibracteata, sp. nov.

Herba terrestris, elata, foliosa. Folia elliptica vel lanceolata, amplectentia. Inflorescentia sublaxe multiflora; bracteae inferiores flores multo superantes; sepala lanceolata, unicarinata, lateralia paulo obliqua; petala ovato-lanceolata; labellum in hypochilium et epichilium divisum; hypochilium valde saccatum nervis quinque incrassatis; epichilium ovato-cordatum, in basi conspicue bicallosum.

Plant tall, about 68 cm. high to the tip of the inflorescence. Stem erect above the more slender basal portion, loosely 7-leaved, the basal third leafless but showing the remains of 3 sheaths, glabrous below, densely short pubescent above. Leaves elliptic-ovate to narrowly lanceolate, many-nerved, the middle ones much the largest, rounded at the sessile more or less clasping base, with the margins and veins of the upper surface minutely papillose-scabrous; lower leaf relatively small, broadly elliptic-ovate, 4.5 cm. long, 3.1 cm. wide, subacute, provided with a close tubular sheath about 2.5 cm. long; middle leaves elliptic to broadly lanceolate, the largest exceeding 12 cm. long (tip broken off), 4.8 cm. wide, lower blades abruptly acute, upper long acuminate; uppermost leaf narrowly lanceolate, 8.7 cm. long, 1 cm. wide near the base, long attenuate. Raceme (rachis) 15.3 cm. long, rather loosely many-flowered. Floral bracts narrowly lanceolate, up to 6 cm. long and 8 mm. wide, foliaceous, long acuminate, the lowest much the largest and about thrice surpassing the flower, the uppermost much reduced and subequaling the subtended flower. Sepals lanceolate, strongly carinate on the outer surface, 5-nerved, the upper part conspicuously papillose without, with recurved tips. Dorsal sepal about 1.3 cm. long, 5 mm. wide across the concave basal part, acuminate. Lateral sepals similar, slightly oblique, about 1.4 cm. long, 5 mm. wide, anterior margin slightly dilated near the concave base, apical margins minutely erose. Petals ovate-lanceolate, about 1.2 cm. long, 4.8 mm. wide near the base, gradually narrowed to an acute complicate tip, 3-nerved with the lateral nerves irregularly branching, the mid-nerve carinate without. Labellum sharply divided into a horizontal hypochil and recurved epichil; hypochil deeply saccate, about 4.5 mm. long, traversed by 5 longitudinal thickened ribs of which the outer has 2 branches; epichil cordate-ovate, 5 mm. long, 4.4 mm. wide near the rounded base, complicate-acute, margins crenate-erose, bearing a pair of large fleshy approximate calli in the center of the base. Column short, very stout, about 3.6 mm. high. Pedicellate ovary clavate, densely short pubescent.

CHINA. Central Kansu. Lien hoa shan: grassy slopes, alt. 2900 m., no. 13216, August, 1925 (flower whitish green) (Type in Herb. Ames, no. 34915).

Apparently allied to **Amesia squamellosa** (Schltr.) C. Schweinfurth, comb. nov. (*Epipactis squamellosa* Schlechter in Fedde Rep. Spec. Nov. Beihefte, IV. 56 [1919]), but differs in being much taller, with longer leaves, and somewhat larger flowers with differently proportioned lip.

In general appearance it recalls the widespread and variable *A. latifolia* (Huds.) Nels. & Macbr. of Europe and North America, but it has larger flowers with more acuminate segments and carinate-veined hypochil of the lip.

Description made from dried specimen.

Oreorchis Rockii, sp. nov.

Herba parva, pusilla. Folium singulum, lanceolato-ellipticum, patens. Scapus folium multo superans, gracilis, vaginis tribus ornatus; racemus laxe 1- ad 3-florus; sepala lateralia lanceolata, valde falcata; sepalum dorsale longius, oblanceolato-oblongum; petala falcato-oblanceolata; labellum trilobatum; lobi laterales parvi, falcato-lanceolati; lobus intermedius multo major, obovato-spathulatus, retusus; discus prope basim bicarinatus.

Plant small for the genus, 8–12.7 cm. high including the terminal flower. Pseudobulb cylindric to ovoid, 5–6 mm. long, with longitudinal axis horizontal or oblique, emitting a few fibrous lanuginose roots. Leaf solitary, basal, slender-petioled; lamina (only one present) elliptic-lanceolate, recurved-spreading, nearly 3 cm. long, about 7 mm. wide, shortly acuminate or acute, cuneate at base, the lower half conduplicate, many-nerved; petiole 1–1.7 cm. long. Scape slender, erect to arcuate, 7.5–11 cm. long when extended, glabrous, provided with 3 tubular sheaths—the lower one marcescent—which are gradually dilated above. Raceme 1- to 3-flowered, very loose. Floral bracts minute, ovate, scarious, spreading. Flowers large for the plant, erect or nearly so, purple according to collector's note. Sepals and petals subconnivent, 5-nerved. Lateral sepals strongly falcate, lanceolate, 10 mm. long, 2.8 mm. wide in the middle, acute or obtuse. Dorsal sepal oblanceolate-oblong, 11.8–12 mm. long, 2.2 mm. wide above the middle, obtuse or acute. Petals oblanceolate, falcate, 9.4–9.7 mm. long, about 2 mm. wide above the middle, subacute, 3- to 5-nerved. Labellum recurved and parallel to the column in natural position, deeply 3-lobed below the middle, shortly clawed with the slightly saccate base adnate to the column, 8.5–9 mm. long when extended, with a pair of short approximate semi-elliptic keels in the center near the base; lateral lobes upcurved in natural position, small, porrect, lanceolate-falcate, rounded at the tip, the free portion 1.5–1.9 mm. long; middle lobe much larger, broadly obovate-spatulate, 5.2–6 mm. long, 5.3–5.8 mm. wide across the rather abruptly dilated anterior half, broadly rounded and minutely retuse, the

sides of the basal portion more or less fleshy-thickened. Column strongly arcuate, 5–6 mm. long, dilated at base, concave on the anterior face. Pollinia 4, complanate-ovoid. Pedicellate ovary clavate, 5–7.7 mm. long.

CHINA. CENTRAL KANSU. Lien hoa shan: alpine meadows, alt. 3000 m., no. 12744, July 14–20, 1925 (Type in Herb. Ames, no. 34914).

Oreorchis Rockii has two rather close allies from the same general region, and it appears to be intermediate between them. It differs from *O. nana* Schltr. in its taller habit, larger flowers, 5-nerved perianth segments and twice longer column. It is a much shorter plant than *O. oligantha* Schltr., with markedly smaller flowers and a retuse lip.

In the dried flowers the sepals and petals appear to be dark brown and the lip lighter with dark spots.

Description drawn from dried specimens.

BOTANICAL MUSEUM OF HARVARD UNIVERSITY
CAMBRIDGE, MASS.

PAPUAN PTERIDOPHYTES COLLECTED FOR THE ARNOLD ARBORETUM BY L. J. BRASS

E. B. COPELAND

THE collection of about 100 specimens of Papuan ferns made by L. J. Brass for the Arnold Arboretum has been received for determination. The country in which Mr. Brass collected was largely covered previously by the Rev. Copland King, and a very large part of Mr. Brass' species were familiar from the King collections. Additional species and notes on species already known follow.

Lycopodium Brassii, sp. nova.

Phlegmaria gracilis, fructuosissima sporophyllis minutis; caule deorsum 3 mm. crasso septangulo, sursum sensim usque ad 0.6 mm. et quadrangulo decrescente, epiphytico, quinties dichotomo, parte sterile 45 cm. longa ramis divaricatis; foliis caulem non occultantibus, deorsum usque ad 7 mm., sursum plerisque circiter 4 mm. longis, circiter 1.6 mm. latis, acutis, subfalcatis, sessilibus vix decurrentibus, integris, glabris, planis, subcoriaceis, costa gracili, ramis cum foliis circiter 7 mm. latis; spicis permultis circiter 11 cm. longis dichotomis rarius iterum furcatis, 1 mm. crassis; sporophyllis circiter 0.6 mm. longis, 0.7 mm. latis, supra basin dilatatam triangularibus, acutis, integris, leviter carinatis vel bicarinatis, quam sporangia fere 1 mm. longa et lata distincte minoribus.

U-uma river, on a tree overhanging the river, no. 1521, May 20, 1926.

A relative of *L. Phlegmaria*, slender in a degree known among species with gradual transition from foliage leaves to sporophylls, but unfamiliar among those with the spikes sharply delimited.

Marattia platybasis, sp. nova.

Trunco teste lectore brevissimo; fronde teste eodem 150–180 cm. longa, cum pinnis oppositis 20–25 cm. remotis; pinna 60 cm. longa,

subsessili, rhachi ima basi articulata, squamis fuscis linearibus usque ad 3 mm. longis aspersa, foliolo apicali 13 cm. longo; pinnulis 20–25-paribus plerisque oppositis, infimis reductis 5 cm. longis, medialibus 12 cm. longis, 15 mm. latis, fere sessilibus, basi utrinque truncatis sed inaequalibus, latere acroscopico circiter 9 mm., basiscopico vix 5 mm. latis, apice in caudas 2 cm. longas 2–3 mm. latas haud abrupte contractis, ubique serratis, subcoriaceis, inferne pallidis; costa inferne deorsum paleis parvis angustissimis paucis praedita, venis simplicibus, 1.5–2.0 mm. remotis, sparsissime squamuliferis; synangiis 1 mm. a margine remotis, vix 2 mm. longis, squama inconspicua persistente subtensis; sporangia circiter 10-paribus.

Ihu, Vailala river, no. 1005, Feb. 19, 1926.

Conspicuous because of the bases of pinnules squarely truncate on both sides. I have fragmentary material of at least two other undescribed Papuan species, collected by Copland King. The genus seems to be rich locally in very distinct species.

Hymenophyllum longifolium van Aldervelt van Rosenburgh.

U-uma river headwaters, Eastern Division, alt. 450–600 m. no. 1467, May 18, 1926 (fronds pendulous from tree trunks).

This species was described from Celebes, the description applying satisfactorily to our specimens with the help of its author's English version showing that the stipe is winged *at least* in the upper part; this wing may be a full millimeter wide on each side. It is nearly related to *H. Junghuhnii*, the head of the receptacle widened to fully twice its length. It differs from that species in its very elongate fronds, broader wings on the rachises and costae, and shorter segments, which may be emarginate as described, or rounded. It may be suspected that the *H. dilatatum* reported in New Guinea by Brause (in Bot. Jahrb. LVI. 40 [1920]) with very long and narrow fronds, is really this species.

Trichomanes atrovirens (Presl) Kunze.

T. rhomboideum J. Smith, nomen nudum.
Cephalomanes rhomboideum v. d. B.

Owen Stanley range, between Mt. Brown and Mt. Clarence, no. 1482; Iwarere, no. 677; perhaps also Ihu, Vailala river, no. 973 (small and ill developed).

Not before reported from New Guinea. Distinguished from *T. javanicum* by the slightly enlarged mouth of the involucre and by the long, curved laciniae on the lower margin of the pinnae. Quite identical with Philippine specimens. Brause (in Bot. Jahrb. LVI. 35, 36 [1920]) has described two Papuan species as related to this, both apparently distinguishable by broader involucres.

Cyathea Brassii, sp. nova.

Caudice gracili teste lectore 6 m. alto et stipite paleaceo, ambobus ceterum ignotis; fronde 2 m. longa, fere tripinnata, rhachi fulva paleis

fulvis usque ad 1 cm. longis angustissimis brevissime castaneo-ciliatis ad bases nigras breves insidentibus mox deciduis ornata, inter quales minute pallide subdecidue arachnoideo-furfuracea, demum paleis abscissis spinulosa; pinnis medialibus 40 cm. longis, abrupte acuminatis, breviter (1 cm.) stipitulatis, rhachi purpureo-maculata, squamulis amorphis pallidis appressis aspersa, glabrescente; pinnulis sessilibus, utroque latere circiter 25, medialibus horizontalibus 6 cm. longis, 15 mm. latis, infra apices abrupte contractis, papyraceis, inferne pallidis haud glaucis, costa superne pilis debilibus rufis et pallidis haud dense pubescente, inferne squamulis sparsis pallidis amorphis obsita et praeciique deorsum paleis nonnullis fere albis nitentibus 1 mm. longis lanceolatis apices suas versus ciliatis ornata; segmentis utroque latere circiter 15, 3 mm. latis, patentibus, subfalcatis, obtusis, serratis, pilis paucis 0.5 mm. longis ciliatis, costula superne pilis paucis incurvatis usque ad 0.7 mm. longis obsita, inferne deorsum squamulis pallide fulvis integris elongato-bullatis valde apiculatis sat dense obsita; venulis circiter 12-paribus plerisque furcatis; soris costularibus circiter 7-paribus, parvis (circiter 0.7 mm. diametro), contiguis, paraphysatis, squamulis laceratis subtensis vel primo involucratis.

Aisa River, Eastern Division, no. 1421, May 15, 1926.—Nom. indig.: *Bunu-bunu.*

A species well characterized by its assortment of peculiar hairs and paleae; not very closely related to the wide-spread and common *C. contaminans,* in spite of their common possession of a so-called false indusium. Abortive sori consist of a cluster of scales, or of a rudiment surrounded by the scales, which as the sori develop, are normally pressed down flat, with only their tips protruding or entirely concealed.

Dryopteris pseudostenobasis, sp. nova.

Rhizomate ignoto, stipite teste lectore 1 m. alto; fronde 130 cm. alta, 50 cm. lata, in apicem parvam pinnatifidam abrupte contracta, pinnis infimis paucis subremotis diminutis, ubique nuda, rhachi pallide fusca deorsum 4 mm. crassa; pinnis medialibus alternantibus, eodem latere rhacheos 3 cm. remotis sessilibus, subhorizontalibus, 25 cm. longis vix 15 mm. latis, sensim in caudam longam integram attenuatis, basin versus subattenuatis papyraceis, profunde pinnatifidis; segmentis 5–6 mm. longis, 3 mm. latis, apice rotundatis, integris, rectis, patentibus; venulis simplicibus, circiter 10-paribus, infimis plerumque anastomosantibus rarius solummodo infra sinus approximatis et parallelis; soris medialibus, circiter 9-paribus nudis et sine paraphysibus; sporis nigris.

Ihu, Vailala river, in rain forests, no. 1000, Feb. 19, 1926. The collector's notes read: "Grows in large masses. Leaves 6–7 ft. long. Lower 3 ft. of (stipe) without pinnae."

To the naked eye, this would pass perfectly for *D. stenobasis* C. Chr. That species, as already shown by the original collection, is quite variable in width of pinnae,—from 1 to 3 centimeters,—and in their contraction

at the base. It is constant in the presence of glandular paraphyses, probably in its minute, glandular indusium, and in the exceedingly minute pubescence of the nether surface, in all of which microscopic characters *D. pseudostenophylla* is different. Both are inconstant in the anastomosis of the lowest veinlets. Mettenius, Phegopteris und Aspidium, no. 233, described the nether surface of *D. stenobasis* as "sub lente minutissime glandulosa;" the spores are likely to make both species look that way.

Dryopteris albo-ciliata, sp. nova.

Caudice erecto brevi, paleis castaneis 1 cm. longis anguste lanceolatis acuminatissimis plerisque minute pubescentibus immerso; stipite 25–30 cm. alto, gracili, stramineo, puberulo; fronde 35–45 cm. alta, 17 cm. lata, acuminata, bipinnatifida, rhachi straminea pilis albis aspersa; pinnis sessilibus valde acuminatis, infimis vix diminutis deflexis, medialibus horizontalibus 8.5 cm. longis, 1 cm. latis, basi hastulatis vel subauriculatis, herbaceis, utraque facie pilis albis ad costam et venas usque at 0.8 mm. longis ad laminam brevioribus obsitis et ciliatis, caudis serrulatis, alibi profunde pinnatifidis; segmentis 4 mm. longis, 2.5 mm. latis, obtusis, integris; venulis simplicibus, 6-paribus, infimis 1-paribus anastomosantibus; soris medialibus; indusiis orbiculari-reniformibus, 0.4 mm. latis, persistentibus, hirsutis haud glanduligeris, integris.

Basiatibu, alt. 450 m., on floor of rain forest, no. 566, Nov. 6, 1925.

Apparently a member of the great group of "*D. parasitica,*" in spite of the absence of reduced basal pinnae, characterized within the group by the white hairs on all parts, including the indusia, and gradually long-acuminate pinnae.

Polystichum lastreoides Rosenstock in Fedde, Rep. Spec. Nov. IX. 425 (August, 1911).

Dryopteris Kingii Copeland in Philip. Jour. Sci. VI. 73 (June, 1911), non C. Chr.

Dryopteris tamatana C. Christensen, Ind. Suppl. 40 (1913).

Brass, Aisa river, on creek banks, no. 1422, May 15, 1926.

My description of this species was based on a specimen of King, no. 149, which had lost its indusia. Rosenstock's was based on King no. 194 and described with "indusio persistente, coriaceo, aterrimo, exacte rotundato-peltato, margine eroso-fimbriata." Mr. King later sent me a frond of his no. 194 and additional material of no. 149, bearing indusia. The two are absolutely identical. The indusia are peltate. On my specimens of both of King's numbers and on Brass's plant they are brown, sometimes approaching black, and perfectly entire.

These indusia make the plant a *Polystichum, by definition,* and Rosenstock ascribed it to the group of *P. varium.* In spite of the indusia, I do not believe that it belongs in this genus.

Tectaria Weinlandii (Christ), comb. nov.

Aspidium Weinlandii Christ in Bull. Herb. Boiss. ser. 2, I. 453 (1901).

Laloki river, no. 541, Oct. 31, 1925.

Larger than the type and with several lateral pinnae, and the indusia fairly persistent; identical with a specimen received under this name from Dr. Rosenstock, Fil. novoguinenses exsic., no. 184, leg. Bamler.

It is related to the common and variable *T. crenata* Cav., and to *T. papuana* Copel. A single frond from the Owen Stanley range, alt. 1050 m., Brass, no. 1480, is intermediate between *T. crenata* and *T. Weinlandii*.

Tectaria craspedocarpa, sp. nova.

Sagenia; rhizomate paleis linearibus atrocastaneis 7 mm. longis integris vestito; stipite usque ad 35 cm. alto, gracili, atropurpureo, nitido, sub lente minute puberulo; fronde trifida basi late cordata vel trifoliata cum foliolo mediali trilobato basi cuneato, usque ad 25 cm. longa, 20 cm. lata, superne costa et inferne tota fronde minute puberula, papyracea, lobis acuminatis, margine integra vel subundulata, lobo, segmento vel foliolo laterali quoque basiscopice acuta et ramo minore praedita; venatione conspicua more Sageniae reticulata; soris magnis (1.5 mm. latis) in lineam fere marginalem instructis, indusio orbiculari-reniforme, integro, persistente.

Laloki river, alt. 450 m., in damp soil under rocks near river, no. 557, Oct. 31, 1925.

Except for the position of the sori, this resembles Malayan specimens called *Aspidium latifolium*, but is not very nearly related to Forster's Polynesian plant. Only one fruiting frond was collected; it has a simple, lobed frond, nearly 20 cm. wide, with the middle segment deformed. The sori form a row almost entirely around it, without a sorus elsewhere.

Asplenium squamuligerum (Rosenst.) Hieronymus in Bot. Jahrb. LVI. 147 (1920), as to the description.

? Iawarere, alt. 300 m., on rocks, no. 671, Nov. 22, 1925.

In dealing with the Mindanao fern, *Athyrium Ramosii* Copeland (in Philip. Jour. Sci. XXXVIII. 140 [1929]) construed as this species by Hieronymus in error, I overlooked the publication of *A. squamuligerum* cited above. The Brass material now in hand conforms to the descriptions. It and the Mindanao species have a remarkable superficial resemblance, although most certainly not nearly related, Brass' plant being a true *Asplenium*.

If this were the whole story, it would be one more illustration of the accident which sometimes befalls even the best collectors,—the confusion of superficially similar plants. This remains barely possible, however; for, on the heels of the Brass collection, I have received from Dr. Rosenstock a good specimen of Keysser's no. 228, the type collection of "*A.*" *squamuligerum*, and this specimen is an unmistakable *Athyrium*.

Following the policy explained in the publication of *A. Ramosii*, of close specific discrimination in this group, I continue to regard Athyrium

squamuligerum (Rosenst.: Hieron.) Copeland, n. comb., and *A. Ramosii* as distinct species, the former being smaller, more finely dissected but less toothed. The apical segments of the pinnae, as represented here, are not entire, but their teeth are far less conspicuous than those of *A. Ramosii*.

Brass' plant may be new; or it may be a very reduced form of a known *Asplenium*.

Dennstaedtia erythrorachis Christ.

U-uma river headwaters, alt. 450 m., no. 1512 (large fern in river bottom).

This is exactly the plant already known from Papua by this name. It is thinner than the Mindanao plant so identified by Christ, and has relatively broader pinnules and smaller sori.

Lindsaya sessilis Copeland.

Ihu, Vailala river, scandent in rain forest, no. 1077.

This collection includes fronds twice as large as those of the type, probably reaching a length of 45 cm. and a width of 5.5 cm., and with stipes about 1 cm. long. The smaller fronds are perfectly typical.

Humata tenuis Copeland.

U-ume river headwaters, alt. 450–600 m., creeping on fallen logs, no. 1465.

The lamina is less contracted than that of the type collection, i. e., the segments are broader.

Cyclophorus aglaophyllus, sp. nova.

Rhizomate 6 mm. crasso, paleis atrocastaneis supra basin 0.5 mm. latam acicularibus densissime vestito; stipitibus caespitosis validis triangularibus superne valde sulcatis 5–15 cm. altis; fronde 60–75 cm. alta, ca. 5 cm. lata, acuminata, deorsum sensim longe attenuata, coriacea superne primo albo-lanosa in vetustate glabra laete castanea, inferne paleis primo pallidis tum demum obscuris inter quales multis cum spina centrali atropurpurea 0.3 mm. longa praeditis vestita; costa valida superne plana v. sulcata, inferne carinata; venis perconspicuis; venulis immersis in reticulationem inconspicuam compactam more Tectariae anastomosantibus; soris minutis, partem superiorem frondis omnino oltegentibus.

Ibelva, Vailala river, no. 1143, March 13, 1926.

A very near relative of the Philippine *C. splendens* from which it is distinguished by much firmer texture, more stipitate fronds, narrower fronds in the case of those seen, and in having the spines from the middle of the scales less than half as long but identical in type.

Cyclophorus stellatus, sp. nova.

C. adnascenti affinis squamulis stellatis densioribus et persistentioribus distinctus, statura minore, rhizomate late repente, 1 mm. crasso, paleis

appressis ovato-lanceolatis 1.5 mm. longis acuminatis atrocastaneis cum puncto fixationis nigro margine albida in vetustate perdita vestito; stipitibus sese 1–2 cm. remotis, ad phyllopodia circiter 1.5 mm. alta articulatis, frondium sterilium 5–10 mm., fertilium 3–4 cm. longis; fronde sterili 2–5 cm. longa, 4–7 mm. lata, acuta v. obtusa, deorsum angustata, coriacea, primo ubique squamulis stellatis densissime vestita in vetustate extrema solummodo superne glabra punctulis nigris aspersa, inferne subglabra, venis omnino occultis; fronde fertili lineari usque ad 10 cm. longa, 5 mm. lata, quam sterilis persistentius squamulosa, ubique basi valde angustata excepta sorifera, soris 0.6–0.8 mm. latis, inter costam gracilem et marginem circiter 4-seriatis.

Territory of New Guinea, Friedrich-Wilhelmshafen, on coconut trunks, *W. A. Setchell*, s. no., March 1904 (type in Herb. Univ. Calif., no. 71391); also Territory of Papua, U-uma River headwaters, *L. J. Brass*, no. 1473.

C. adnascens is common on coconut trunks well throughout the eastern tropics. It varies widely in size and shape of fronds; but almost always its sterile fronds are larger than those of *C. stellatus*, and always relatively broader and more rounded, and more promptly glabrescent; and its fertile fronds, commonly broader throughout, are almost always broadest and sterile near the base. In another direction, *C. stellatus* shows affinity to *C. rupestris*, and thus to *C. dispar*.

Cyclophorus dimorphus, sp. nova.

Rhizomate late repente fere 2 mm. crasso, duro, paleis vel relictis palearum appressis lanceolatis nigris anguste albide marginatis et ciliatis persistentibus vestito; stipitibus vix 2 cm. inter sese distantibus, ad phyllopodia 2–4 mm. longa articulatis, superne sulcatis, frondium sterilium 2–3 cm., fertilium 3–5 cm. longis, sursum alatis; fronde sterili circiter 6 cm. longa, 2 cm. lata, basi cuneata, apice late rotundata, rigide coriacea, utraque facie paleis minutis albidis stellatis sparsis et inconspicuis persistentibus praedita; costa inferne deorsum conspicua apicem versus occulta, venis omnino immersis; fronde fertili 15–20 cm. longa, 1 cm. lata, explanata sed in speciminibus convoluta et deinde vix 5 mm. lata, obtusa, basi excepta soris circiter 1 mm. latis dense obtecta, costa inferne conspicua, gracili.

Lower Mori river, on exposed rocks at river mouth, no. 1575, May 28, 1926.

Nearly related to the wide-spread and variable *C. adnascens*, from which the persistent though inconspicuous pubescence of both surfaces distinguishes it; it is also peculiar in having larger and more broadly rounded sterile fronds than are usual in that species. It may be near to *C. Ledermanni* Brause, but that is described as having the sterile fronds densely pilose beneath, the apex abruptly contracted to a short apex, and the stipes winged to the base. It is probably closer to the little-known *C. pachydermus*, and like it in having rather large sori, for

the group. That species, from Kei, is described as smaller throughout, with naked upper surface. No rhizome tip is present and the young paleae are accordingly not known. A lacerate whitish margin persists until they are quite old.

Brause (in Bot. Jahrb. LVI. 205 [1902]) lists ten species of *Cyclophorus* as known in New Guinea, and *C. varius* is quite surely still to be reported. The following artificial key will serve to distinguish the species now known there.

Cyclophorus of New Guinea

Fronds commonly 30 cm. or more long
- Main veins conspicuous
  - Stellate paleae with a central spine ..... 1. *C. aglaophyllus*
  - Stellate paleae without a central spine ..... 2. *C. princeps*
- Main veins invisible ..... 3. *C. acrostichoides*

Fronds smaller
- Sori in one row on each side of costa
  - Sori immersed ..... 4. *C. Lauterbachii*
  - Sori superficial ..... 5. *C. confluens*
- Sori numerous
  - Fronds uniform ..... 6. *C. macropodus*
  - Fronds dimorphous but equally long ..... 7. *C. Ledermanni*
  - Sterile fronds shorter than fertile
    - Fertile fronds subsessile ..... 8. *C. dispar*
    - Fertile fronds stipitate
      - Sterile fronds acute, about 10 cm. long ..... 9. *C. Bamleri*
      - Sterile fronds obtuse, usually smaller
        - Upper surface stellate
          - Sterile fronds under 1 cm. wide ..... 10. *C. stellatus*
          - Sterile fronds larger ..... 11. *C. dimorphus*
        - Upper surface glabrescent
          - Sori about 1 mm. broad ..... 12. *C. pachydermus*
          - Sori smaller ..... 13. *C. adnascens*

Microsorium Brassii, sp. nova.

Rhizomate ad terram repente, gracili, 1.3 mm. crasso, paleis erecto-patentibus lanceolato-ovatis fuscis membranaceis integris 1–1.5 mm. longis acuminatis basibus aut peltatis aut cordatis persistentibus vestito; stipitibus plus minusve 2 cm. inter sese remotis, 2–3 cm. longis, non articulatis, gracilibus, laete castaneis, paleis parvis paucis adspersis; fronde 15–20 cm. longa, 10–12 mm. lata, utrinque acuminata, integra, membranacea, glabra, costa gracili inferne praestante; venis $\frac{2}{3}$ ad marginem protensis et seriem unam areolarum magnarum includentibus, venulis in reticulam areolarum secundariarum anastomosantibus, cum liberis inclusis simplicibus vel hamatis; soris in areolis primariis solitariis, rarissime duo, deinde utroque latere costae uniseriatis, ad costam quam ad marginem propioribus, parvis, superficialibus.

Upoia, Vailala river, on wet clay river bank, no. 1153, March 15, 1926.

Similar to *Polypodium wobbense* Brause in general appearance and texture, but smaller, narrower, and with the sori seriate. *P. Raapii* v. A. v. R., of the Batu Islands, must be a very similar species, but is described as having two or three rows of irregular areolae, naked stipes,

and glabrescent rhizomes. The single row of major areolae of *M. Brassii* is decidedly regular. With the adoption of the terrestrial habitat, the articulation of the stipe, characteristic of the group, has effectively disappeared.

Merinthosorus drynarioides (Hooker) Copeland in Philip. Jour. Sci. Bot. VI. 92 (1911).

Acrostichum drynarioides Hooker, Sp. Fil. v. 282.
Photinopteris drynarioides Beddome, Ferns Brit. India, pl. 325.
Dryostachyum drynarioides Kuhn in Ann. Lugd.-Bat. IV. 296; Forschungsreis. Gazelle, pl. II.

Owen Stanley range, between Mt. Brown and Mt. Clarence, alt. 1375 m., no. 1503 (coarse ground fern).

The type of the genus, collected by Copland King, shows no locality more definite than "Papua," and consists of the upper part of a frond. Beddome's figure is equally incomplete. Kuhn's illustration shows an entire frond, with dilated base, and with fertile pinnae longer than the sterile segments. Brass's specimen has a contracted base and comparatively short fertile pinnae, conforming at least in the former respect with Hooker's description.

Whether we have to deal with a single species, or with two or more, may best not be decided from the available information. In some ferns of this group, the form of the base is a fixed specific character; in others, I believe it to be very inconstant. If a Papuan species of this genus is fixed in its terrestrial habitat, it can hardly be conspecific with the one with broad base, figured by Kuhn. The ancestry is surely epiphytic.

HERBARIUM, UNIVERSITY OF CALIFORNIA
BERKELEY, CALIFORNIA

TWO NEW RHODODENDRONS OF THE TSUTSUTSI SECTION

ALFRED REHDER

Rhododendron annamense, spec. nov.

Frutex ramis erectis subverticillatis; ramuli dense pilis brevibus paleaceis fulvis ad secundum annum persistentibus vestiti, vetustiores fusco-grisei. Gemmae florales perulis pluribus late ovatis subito acuminulatis secus medium dorsum minute puberulis et strigosis marginem ciliatum versus glabris. Folia persistentia, chartacea, anguste oblongo-lanceolata vel oblanceolata, 2.5–6.5 cm. longa et 6–8 mm. lata, acuta vel breviter acuminata, basi anguste cuneata, initio utrinque dense pilis adpressis applanatis fulvis nitentibus vestita, maturitate sparsius strigosa, supra interdum glabrescentia vel pilis griseis conspersa, atroviridia, leviter rugulosa, costa non impressa, subtus pallide viridia, satis dense strigosa, ad costam dense paleaceo-strigosa, margine integra, adpresse ciliata;

petioli 3–7 mm. longi, supra plani, dense breviter paleaceo-strigosi. Inflorescentia 1–2-flora; pedicelli circiter 5 mm. longi, dense paleaceo-strigosa; sepala inaequalia, ovato-oblonga vel oblonga, 3–5 mm. longa, obtusa, extus dense longeque setosa-strigosa, intus glabra; corolla infundibuliformis, 4–4.5 cm. longa, ut videtur roseo-purpurea et maculis destituta, tubo 18–20 mm. longo a basi sensim dilatato extus glabro intus leviter papilloso-pilosa, lobis ovalibus 2.2–2.5 cm. longis et 15–17 mm. latis glabris; stamina 10, inaequalia, fere recta, longiora corollam aequantia, breviora lobos medios attingentia, filamentis infra medium papilloso-pilosis basi complanatis, antheris oblongis 2 mm. longis purpureo-fuscis; ovarium dense adpresse setoso-strigosum; stylus 4.5–5 cm. longus, corollam superans, leviter vel vix curvatus, glaber, stigmate capitato.

ANNAM: near Hué, *R. W. Squires*, no. 94, Jan. to May, 1927.

This new species is most nearly related to *R. hainanense* Merr. which differs chiefly in its considerably smaller flowers, smaller leaves glaucescent beneath and glabrous or nearly glabrous at maturity except the strigose midrib, glabrous above at maturity. The species extends the range of the Tsutsutsi section beyond China into Annam.

Rhododendron Simsii Planch. var. **mesembrinum**, var. nov.

Rhododendron mesembrinum Balfour f. & Forrest in sched.—[Rhododendron Society], A list of Rhododendrons in their series. Ed. 1 & 2, p. 7 (1925), ed. 3, p. 7 (1927), name only.

A typo recedit praecipue corolla minore circiter 3 cm. longa alba et extus roseo suffusa intus purpureo-maculata, tubo intus leviter papilloso-piloso, foliis minus dense strigosis subtus glaucescentibus.—Frutex 2–2.5 m. altus, ramulis, petiolis, pedicellis, costa media subtus densissime fusco-paleaceo-strigosis. Folia anguste elliptica ad oblongo-ovata, 1.5–4.5 cm. longa, acuta vel acutiuscula, mucronata, supra satis sparse pilis arcte adpressis strigosis basi bulbosis vestita, subtus glaucescentia sparsius pilis fuscis strigosis vestita. Inflorescentia 2–6-flora, pedicellis perbrevibus; sepala semiorbicularia ad late ovata, 1–2 mm. longa, extus dense longe setosa; corolla infundibuliformis, circiter 3 cm. longa, alba extus roseo suffusa, ad basin lobi superioris purpureo-maculata, lobis ovalibus tubum circiter aequantibus; stamina 10, inaequalia, longiora quam corolla breviora, filamentis infra medium pilosis; stylus glaber, corollam aequans vel paullo longior; ovarium dense strigosum.

YUNNAN: Jang-tzow shan, Shweli-Salwin divide, Lat. 25°, 10′, *G. Forrest*, no. 17914, May, 1919 (shrub 6–8 ft.; flowers white, flushed rose exterior, with a few crimson markings; in mixed thickets).

On account of the smaller more numerous white flowers this Azalea appears at the first glance quite different from typical *Rh. Simsii* Pl., but there is no morphological character to separate it specifically. The other white form described, *Rh. Simsii* var. *eriocarpum* (Hay.) Wilson from the Kawanabe Islands, has larger flowers and broader often obovate

more pubescent leaves, and the corolla apparently lacks the crimson markings.

The variety looks in flower and leaf somewhat intermediate between *Rh. Simsii* and *Rh. microphyton* Franch. which was collected by Forrest at the same locality (no. 17918), but the latter species is easily distinguished by its much smaller corolla, with cylindric tube and 5 stamens exceeding the corolla-lobes, and by its smaller leaves.

NOTES ON THE LIGNEOUS PLANTS DESCRIBED BY H. LÉVEILLÉ FROM EASTERN ASIA[1]

ALFRED REHDER

ARISTOLOCHIACEAE

Aristolochia moupinensis Franchet in Nouv. Arch. Mus. Paris, sér. 2, X. 79 (Pl. David. II. 117) (1887).

Aristolochia Bonatii Léveillé in Bull. Soc. Bot. France, LVI. 608 (1909); Cat. Pl. Yun-Nan, 11 (1915).

CHINA. Yunnan: taillis des montagnes, *E. E. Maire*, Herb. Bonati, no. 446, July, 1906 (type of *A. Bonatii*).

The leaves are less pubescent than usually in *A. moupinensis*, but otherwise the specimen agrees with that species.

Aristolochia Feddei Léveillé in Fedde, Rep. Spec. Nov. XII. 287 (1913); Cat. Pl. Yun-Nan. 13 (1915).

CHINA. Yunnan: rochers de Ti-li, alt. 2800 m., *E. E. Maire*, June [1910–14] (type).

POLYGONACEAE

Polygonum emodi Meisn. var. **dependens** Diels in Notes Bot. Gard. Edinb. V. 256 (1912).

Polygonum zigzag Léveillé & Vaniot in Fedde Rep. Spec. Nov. VI. 112 (1908)—Léveillé, Cat. Pl. Yun-Nan, 208 (1916).

CHINA. Yunnan: Lou-pou, près Tong-chouan, *J. Tchang*, no. 541, Sept. 1906 (type; ex Léveillé).

Polygonum zigzag Lévl. & Van. of which I have seen no specimen is according to Dr. G. Samuelsson (in litt.) identical with *P. emodi* var. *dependens* Diels. The variety *dependens* Diels known only from Yunnan seems to differ very little from the Himalayan type except in its more vigorous habit and larger leaves, but Schneider's no. 3675 from Chung-tien, Yunnan, is scarcely different from the type.

Polygonum urophyllum Franchet & Bureau in Jour. de Bot. V. 150 (1891).

Polygonum Mairei Léveillé in Fedde Rep. Spec. Nov. VII. 338 (1909); Cat. Pl. Yun-Nan, 208 (1916).

CHINA. Yunnan: Yun-nan-sen, haies, montagnes arides, *E. E.*

[1] Continued from p. 132.

Maire, nos. 348, 366, May, June, 1904–1905 (type; ex Léveillé); rocailles à mi-mont de Kiang-ti, alt. 2000 m., *E. E. Maire*, [1911–14].

Léveillé's species has been identified by Dr. G. Samuelsson (in litt.) with *P. urophyllum* Franch. & Bur. Of this species I have seen only the specimen from Kiang-ti which is not cited by Léveillé and bears the name "*Polygonum Statice* Levl." in Léveillé's handwriting on the label, but in Léveillé's herbarium it was correctly placed in the folder of *P. Mairei*. There is also a specimen in the Bonati Herb. under no. 7482 Ser. B. labeled "*P. Mairei* Lév.?" and collected by E. E. Maire at Kin-tchong-tschau, alt. 2800 m., Juin 1910. The species is known only from Yunnan.

Polygonum multiflorum Thunberg, Fl. Jap. 169 (1784);—Meisner, Monog. Gen. Polygon. 64, t. 4, fig. *Q* (1826); in De Candolle, Prodr. XIV. 136 (1856).

Polygonum Statice Léveillé in Fedde, Rep. Spec. Nov. VII. 338 (1909); Fl. Kouy-Tchéou, 321 (1915).

CHINA. Kweichou: without locality, *J. Esquirol*, no. 164 (type of *P. Statice;* ex Léveillé).

Léveillé's species of which I have seen no specimen is according to Dr. Samuelsson *P. multiflorum* Thbg. The species is widely distributed throughout China and extends to Manchuria, Japan and Formosa.

AMARANTHACEAE

Deeringia amaranthoides (Lam.) Merrill, Interpret. Herb. Amb. 211 (1917).

Deeringia baccata (Retz.) Moquis-Tandon in De Candolle, Prodr. XIII. pt. II. 236 (1849).

Mallotus neo-Cavaleriei Léveillé, Fl. Kouy-Tchéou, 165 (1914).

CHINA. Kweichou: Lo-fou, *J. Cavalerie*, no. 3516, March, 1909 (type of *Mallotus neo-Cavaleriei*).

RANUNCULACEAE

Clematis fusca Turczaninow in Bull. Soc. Nat. Moscou, XIII. 60 (1840).—Finet & Gagnepain in Bull. Soc. Bot. France, I. 516 (1903); Contrib. Fl. As. Or. I. 31, 40 (1905).

Clematis Coreana Léveillé in Bull. Acad. Intern. Geog. Bot. XI. 298 (1902).—Nakai in Jour. Coll. Sci. Tokyo, XXVI. art. 1, p. 11 (Fl. Kor. I) (1909).—Non *C. koreana* Komar.

KOREA. Monts Nai-piang, 1208 m., *U. Faurie*, no. 8, July, 1901 (type of *C. Coreana;* ex Léveillé).

Finet & Gagnepain have referred *C. Coreana* which I have not seen to *C. fusca*.

Clematis Clarkeana Léveillé & Vaniot in Bull. Acad. Intern. Geog. Bot. XI. 170 (1902).—Léveillé, Fl. Kouy-Tchéou, 332 (1915); Cat. Pl. Yun-Nan, fig. 56 (1917).—Finet & Gagnepain in Bull. Soc. Bot. France, L. 545 (1903); Contrib. Fl. As. Or. I. 30 (1905).

CHINA. K w e i c h o u : environs de Gan-pin, dans la depression, grotte, *L. Martin & E. Bodinier*, no. 1990, Oct. 24, 1897 (type).

Clematis pterantha Dunn in Hooker's Icon. Pl. XXVIII. t. 2713 (1913).—Finet & Gagnepain in Bull. Soc. Bot. France, L. 544 (1903); Contrib. Fl. As. Or. I. 29 (1905).—Léveillé, Fl. Kouy-Tchéou, 333 (1915).

Clematis Philippiana Léveillé & Vaniot in Bull. Acad. Intern. Geog. Bot. XI. 169 (1902).

CHINA. K w e i c h o u : environs de Lo-pie, Tchen-li-tchéou, borde de la route, haies, *L. Martin & E. Bodinier*, no. 1992, Oct. 6, 1897 (type of *C. Philippiana*).

Clematis Leschenaultiana De Candolle, Syst. I. 151 (1818).—Finet & Gagnepain in Bull. Soc. Bot. France, L. 542 (1903); Contrib. Fl. As. Or. I. 27 (1905).—Léveillé, Fl. Kouy-Tchéou, 333 (1915).

Clematis splendens Léveillé & Vaniot in Bull. Acad. Intern. Geog. Bot. XI. 171 (1902), quoad specim. nos. 2248 et 2248 bis.

CHINA. K w e i c h o u : environs de Hoang-ko-chou dans les rocailles, *L. Martin* in herb. Bodinier, no. 2248bis, Feb. 10, 1899 (syntype of *C. splendens*); district de Tchen-lin, environs de Lo-pie, *J. Seguin* in herb. Bodinier, no. 2248, March, 1898 (syn-type of *C. splendens*).

The identification by Finet & Gagnepain of *C. splendens* with this and the following species was accepted by Léveillé in his Flore de Kouy-Tchéou.

Clematis rubifolia Wright in Kew Bull. Misc. Inform. 1896, p. 21.—Finet & Gagnepain in Bull. Soc. Bot. France, L. 543 (1903); Contrib. Fl. As. Or. I. 28 (1905).—Léveillé, Fl. Kouy-Tchéou, 333 (1915).

Clematis splendens Léveillé & Vaniot in Bull. Acad. Intern. Geog. Bot. XI. 171 (1902), exclud. specim. nos. 2248 et 2248 bis.

CHINA. K w e i c h o u : environs de Tsin-gay, vallée de Kia-la tchong, *J. Laborde* in herb. Bodinier, no. 2024, Dec. 1897, 1898 (syntype of *C. splendens*).

Clematis montana Buchanan-Hamilton apud De Candolle, Syst. I; 164 (1818).—Finet & Gagnepain in Bull. Soc. Bot. France, L. 524 (1903). Contrib. Fl. As. Or. I. 9 (1905).—Léveillé, Fl. Kouy-Tchéou, 333 (1915).

Clematis Kuntziana Léveillé & Vaniot in Bull. Acad. Intern. Geog. Bot. XI. 171 (1902).

CHINA. K w e i c h o u : borde de la route entre Hin-y-fou et le fleuve Hoa-kiang, *E. Bodinier*, no. 1576, April 20, 1897 (type of *C. Kuntziana;* ex Léveillé).

Finet & Gagnepain have referred *C. Kuntziana* which I have not seen to *C. montana.*

Clematis Vanioti Léveillé & Porter in Fedde, Rep. Spec. Nov. VII. 20 (1910).— Léveillé, Fl. Kouy-Tchéou, 334 (1915).

CHINA. K w e i c h o u : Lo-fou, *J. Cavalerie*, no. 3581, March, 1909 (type).

This species seems related to *C. Armandi* Franch., but differs considerably in its 5-foliolate leaves and in the 3-flowered long-peduncled inflorescence with the pedicels about as long as the peduncle and the lateral ones with small broad basal bractlets; sometimes the peduncle is 1-flowered.

Clematis smilacifolia Wallich in As. Research. XIII. 402 (1820).—Hooker in Bot. Mag. LXXII. t. 4259 (1846).

Clematis Esquirolii Léveillé & Vaniot in Bull. Herb. Boissier, sér. 2, VI. 504 (1906).—Léveillé, Fl. Kouy-Tchéou, 332 (1915).

CHINA. Kweichou: Pin-tong, *J. Esquirol*, no. 264, Dec. 25, 1904 (type of *C. Esquirolii*); Lo-fou, Pin-yang, *J. Cavalerie*, nos. 2663 and 3578, Dec. 1905 and March, 1909 (sub *C. Esquirolii* in Léveillé, Fl. Kouy-Tchéou, l. c.).

Clematis Duclouxii Léveillé in Fedde, Rep. Spec. Nov. VII. 97 (1909); Cat. Pl. Yun-Nan, 220 (1917).

CHINA. YUNNAN: Tso-kio, sur la route de Yun-nan-sen à Houy-ly-tcheou, *Martin, Ma.*, no. 575, March, 1907 (type).

This species seems nearest to *C. Pavoliniana* Pamp. from which it differs in the simple leaves and in the obtuse anthers with a minute obtuse mucro and in the white hairs of the carpels; the two pairs of simple leaves present in the type specimen may be reduced from normally 3-foliolate or pinnate leaves, as it sometimes happens in the leaves of lateral branchlets.

Clematis Pavoliniana Pampanini in Nuov. Giorn. Bot. Ital. n. ser. XVII. 270 (1910).

Clematis Finetiana Léveillé & Vaniot in Bull. Soc. Bot. France, LI. 219 (1904).—Léveillé, Fl. Kouy-Tchéou, 332 (1915).

CHINA. Kweichou: Pin-fa, *J. Cavalerie*, no. 1347, May 5, 1902 (syn-type of *C. Finetiana*); Pin-fa, borde des ruisseaux, *J. Cavalerie*, no. 605, Oct. 5, 1902 (syn-type of *C. Finetiana*).

Clematis chinensis Retzius, Observ. II. 18 no. 53, t. 2 (1781).—Finet & Gagnepain in Bull. Soc. Bot. France, L. 535 (1903); Contrib. Fl. As. Or. I. 20 (1905).—Rehder & Wilson in Sargent, Pl. Wilson. I. 329 (1913).—Léveillé, Fl. Kouy-Tchéou, 332 (1915).

Clematis funebris Léveillé & Vaniot in Bull. Acad. Intern. Geog. Bot. XI. 168 (1902).

Clematis oligocarpa Léveillé & Vaniot, op. cit. XVII. no. 210–11, p. II (1907).—Léveillé, Fl. Kouy-Tchéou, 333 (1915).

Clematis Cavaleriei Léveillé & Porter in Fedde, Rep. Spec. Nov. IX. 20 (1910).—Léveillé, Fl. Kouy-Tchéou, 332 (1915).

CHINA. Kweichou: environs de Gan-pin, *L. Martin & E. Bodinier*, no. 1787, Aug. 9, 1897 (type of *C. funebris;* ex Léveillé & Vaniot and Finet & Gagnepain); route de Pin-fa, Sang-li, *J. Cavalerie* no. 2490, Aug. 19–20, 1911 (type of *C. oligocarpa*); Gan chouen, *J. Cavalerie*, no. 2490 [bis] Nov. 1909 (under *C. oligocarpa* in Fl. Kouy-Tchéou); Lo-fou, *J. Cavalerie*, no. 3582, March, 1909 (type of *C. Cavaleriei*).

Finet & Gagnepain have already identified *C. funebris* with *C. chinensis*, and this determination has been accepted by Léveillé in his Flore de Kouy-Tchéou. *Clematis Cavaleriei* differs somewhat from typical *C. chinensis* in the narrower leaflets cuneate at base and slightly pubescent on the veins, and in the sepals being rather densely pubescent outside.

Clematis uncinata Champion in Hooker's Jour. Bot. & Kew Gard. Misc. III. 255 (1851).—Finet & Gagnepain in Bull. Soc. Bot. France, L. 523 (1903); Contrib. Fl. As. Or. I. 8 (1905).—Rehder & Wilson in Sargent, Pl. Wilson, I. 327 (1913).—Léveillé, Fl. Kouy-Tchéou, 334 (1915).

Clematis Drakeana Léveillé & Vaniot in Bull. Acad. Intern. Geog. Bot. XI. 168 (1902).

Clematis Gagnepainiana Léveillé & Vaniot in Bull. Soc. Bot. France, L. 219 (1904).—Léveillé, Fl. Kouy-Tchéou, 332 (1915).

CHINA. Kweichou: environs de Kouy-yang, mont du Collège, gorges de Yang-pa, *E. Bodinier*, no. 1680, June 20, 1898 (syn-type of *C. Drakeana;* ex Léveillé & Vaniot); environs de Gan-pin, *L. Martin & L. Bodinier*, no. 1680 [bis], July 3, 1897 (syn-type of *C. Drakeana;* ex Léveillé & Vaniot and Finet & Gagnepain); Pin-fa, montagnes boisées, *J. Cavalerie*, no. 664, Oct. 30, 1902 (type of *C. Gagnepainiana*).

Clematis Drakeana had already been identified with *C. uncinata* by Finet & Gagnepain and enumerated under the latter name by Léveillé in his Flore de Kouy-Tchéou.

Clematis paniculata Thbg. var. **dioscoreifolia** Rehder in Jour. Arnold Arb. I. 195 (1920).

Clematis dioscoreifolia Léveillé & Vaniot in Fedde, Rep. Spec. Nov. VII. 339 (1909).

KOREA. Quelpaert: in sepibus Hogno, *E. Taquet*, no. 502, Sept. 2, 1908 (type).

Clematis Chanetii Léveillé in Fedde, Rep. Spec. Nov. XI. 495 (1913).

CHINA. Chili: Kia-chan, *L. Chanet*, no. 560, Aug. 1910 (type); montagnes de Ping-chan, *L. Chanet*, no. 229, June 15, 1908 (sub *C. Chanetii* in Herb. Léveillé).

As stated by Léveillé in his description the species is related to *C. Flammula* L., which has not yet been recorded from northern China, and until I have seen more complete material, I hesitate to identify it with that species. From other related species as *C. paniculata* Thbg., and *C. chinensis* Retz. it differs in its bipinnate leaves and from *C. angustifolia* Jacq. in its climbing habit, axillary inflorescences and different venation of the leaflets. The plant seems to blacken in drying like *C. chinensis*.

Clematis Gouriana Roxburgh apud De Candolle, Syst. I. 138 (1818).

Clematis Martini Léveillé in Bull. Acad. Intern. Geog. Bot. XVII. no. 210–11, p. II (1907); Fl. Kouy-Tchéou, 333 (1915).

CHINA. Kweichou: route de Pien-yang à Lo-fou, *J. Cavalerie*, no. 2662, Nov. 1905 (type of *C. Martini;* ex Léveillé); bords du fleuve

Hoa-kiang, *J. Esquirol*, no. 576, Aug. 5, 1905 (syn-type of *C. Martini*); Lo-fou, *J. Cavalerie*, no. 3583, March, 1909 (sub *C. Martini* in Léveillé, Fl. Kouy-Tchéou).

LARDIZABALACEAE

Akebia trifoliata Koidz. var. **australis**, comb. nov.

Akebia lobata Dcne. var. *australis* Diels in Bot. Jahrb. XXIX. 344 (1900).
Akebia Chaffanjoni Léveillé in Bull. Soc. Agr. Sci. Sarthe, XXXIX. 316 (Bouquet Fl. Chine 1) (1904); in Fedde, Rep. Spec. Nov. VI. 372 (1909).
Akebia lobata var. *Chaffanjoni* Léveillé, Fl. Kouy-Tchéou, 47 (1914).

China. Kweichou: environs de Kouy-yang, Gan-pin, mont du Collège, *J. Chaffanjon* in herb. Bodinier, no. 2159, April 3, 1898 (fruit comestible; type of *A. Chaffanjoni*).

Holboellia coriacea Diels in Bot. Jahrb. XXIX. 342 (1900).

Artabotrys Esquirolii Léveillé, Fl. Kouy-Tchéou, 29 (1914).

China. Kweichou: Gny-hien, bords du ruisseau, 700 m., *J. Esquirol*, no. 2184, June, 1910 (syn-type of *Artabotrys Esquirolii*).

The description by Léveillé does not seem to fit Esquirol's no. 2184; the other syn-type, Esquirol's no. 2033, I have not seen.

Holboellia spec.

Akebia Cavaleriei Léveillé, Fl. Kouy-Tchéou, 47 (1914).

China. Kweichou: Pin-fa, contreforts de Yuin-ou-chan; *J. Cavalerie*, no. 955, May 28, 1903 (type of *Akebia Cavaleriei*).

This species seems nearest to *H. coriacea* Diels, but the leaves are mostly 4-foliolate and the leaflets rather small and usually obtuse.

BERBERIDACEAE

Berberis Griffithiana Schneider in Bull. Herb. Bossier ser. 2, v. 403 (1905); VIII. 198 (1908).—Léveillé, Fl. Kouy-Tchéou, 48 (1914).

Berberis Cavaleriei Léveillé in Fedde Rep. Spec. Nov. IX. 454 (1911).

China. Kweichou: entre Kouen-chan et Kouy-yang, *J. Cavalerie*, no. 3209, April, 1907 (type of *B. Cavaleriei;* ex Léveillé).

I have not seen Cavalerie's no. 3209 and follow Léveillé who in his Flore de Kouy-Tchéou refers it to *B. Griffithiana.*

Berberis bicolor Léveillé in Fedde, Rep. Spec. Nov. IX. 454 (1911).

China. Kweichou: Ma-jo, *J. Cavalerie*, no. 3043, May, 1908 (hauteur 1.50 m.; fleurs exterieurement rouges, interieurement blanches; type).

This species seems very near *B. Gagnepainii* Schneid., but the leaves are broader with the margin scarcely undulate and with rather fine appressed-setose serration.

Berberis Wilsonae Hemsley in Kew Bull. Misc. Inform. 1906, p. 151; in Bot. Mag. CXXXVIII. t. 8414 (1912).—Léveillé, Fl. Kouy-Tchéou, 48 (1914), as *B. Wilsoni.*

Berberis Bodinieri Léveillé in Fedde, Rep. Spec. Nov. IX. 454 (1911); Cat. Pl. Yun-Nan, 17 (1915).

CHINA. Kweichou: Long-li, Ma-jo, *J. Cavalerie*, no. 3042, Nov. 1908. Yunnan: environs de Yun-nan-sen, *E. Bodinier*, Nov. 17, 1896 (type of *B. Bodinieri*).

I have seen neither of the specimens enumerated above. In his Flore de Kouy-Tchéou Léveillé refers his *B. Bodinieri* to *B. Wilsonae*, but cites Cavalerie's no. 3042 from Kwei-chou which he did not mention with his original description.

Mahonia ganpinensis Fedde, Rep. Spec. Nov. VI. 372, nota (1909).—Léveillé, Fl. Kouy-Tchéou, 49 (1914).—Takeda in Notes Bot. Gard. Edinb. VI. 238 (1917).

Berberis (*Mahonia*) *Ganpinensis* Léveillé in Bull. Soc. Agr. Sci. Arts Sarthe, XXXIX. 317 (Bouquet Fl. Chin. 2) (1904); in Fedde, Rep. Spec. Nov. VI. 372 (1909).

Mahonia confusa Sprague in Kew Bull. Misc. Inform. 1912, p. 339.—Takeda in Notes Bot. Gard. Edinb. VI. 234 pl. 25, 26, fig. 168–172 (1917).

Mahonia Zemanii Schneider in Sargent, Pl. Wilson. I. 378 (1913).

CHINA. Kweichou: environs de Gan-pin dans la grande depression-caverne, *L. Martin* in herb. Bodinier, no. 1929, Oct. 24, 1897 (type of *B. ganpinensis*); Ma-jo, *J. Cavalerie*, no. 3054, Sept. 5, 1907 (under *M. ganpinensis* in Fl. Kouy-Tchéou).

The type specimens of *M. confusa* Sprague and *M. Zemanii* Schneid. are almost identical but differ from typical *M. ganpinensis* in the more numerous and broader leaflets, about 7 pairs, while typical *M. ganpinensis* has 4 to 5 pairs not counting the small basal pair; the leaflets are up to 12 mm. and in Cavalerie's no. 3054 not more than 8 mm. wide. The difference in the width of the leaflets between the Kweichou and the Hupeh specimens is more pronounced than that between Henry's nos. 3117 and 3351, syn-types of *M. confusa*, while Wilson's no. 2883, the type of *M. Zemanii*, agrees well with Henry's no. 3117. *Mahonia confusa* had been already referred to *M. ganpinensis* by C. Schneider in the herbarium of the Arnold Arboretum.

MAGNOLIACEAE

Michelia Martini Finet & Gagnepain apud Léveillé, Fl. Kouy-Tchéou, 270 (1914).—Dandy in Kew Bull. Misc. Inform. 1927, p. 263.

Magnolia Martini Léveillé in Bull. Soc. Agr. Sci. Art. Sarthe, XXXIX. 321 (Bouquet Fl. Chin. 6) (1904); in Fedde, Rep. Spec. Nov. VI. 374 (1909).

CHINA. Kweichou: environs de Gan-pin, a Leang-chouy-tsin, *L. Martin* in herb. Bodinier, no. 2066, 9–20 Febr. 1898 (fleurs blanc-crême; type of *Magnolia Martini*).

Michelia Leveilleana Dandy in Kew Bull. Misc. Inform. 1927, p. 263.

Michelia Cavaleriei Léveillé in Fedde, Rep. Spec. Nov. IX. 459 (1911); Fl. Kouy-Tchéou, 270 (1914).—Non Finet & Gagnepain.

CHINA. Kweichou: Ma-jo and Lon-mong-touan, *J. Cavalerie*, no. 3045, Apr. and May, 1908 (type of *M. Cavaleriei*).

Kadsura chinensis Hance in Bentham, Fl. Hongkong. 8 (1861).—Léveillé, Fl. Kouy-Tchéou, 269 (1914).

Kadsura (*Schizandra*) *Cavaleriei* Léveillé in Fedde, Rep. Spec. Nov. IX. 459 (1911).

CHINA. K w e i c h o u : Pin-fa, près de cascades, *J. Cavalerie*, no. 3046, Mai (type of *K. Cavaleriei*), no. 1023, May 28, 1903.

Schizandra Henryi Clarke in Gard. Chron. ser. 3, XXXVIII. 162, fig. 55 (1905).

Schizandra hypoglauca Léveillé in Fedde, Rep. Spec. Nov. IX. 459 (1911); Fl. Kouy-Tchéou, 270 (1914); Cat. Pl. Yun-Nan, 175 (1916).

CHINA. K w e i c h o u : without precise locality, *J. Esquirol*, no. 58, May 7, 1904 (liane; fleurs jaunes; type of *S. hypoglauca*).

Schizandra propinqua Hook. f. & Thoms. var. **sinensis** Oliver in Hooker's Icon. XVIII. t. 1715 (1887).

Embelia Valbrayi Léveillé, Cat. Pl. Yun-Nan, 177 (1916).

CHINA. Y u n n a n : rochers derrière La-kou, alt. 2400–2500 m., *E. E. Maire*, July, Sept., 1912 (type of *Embelia Valbreyi*).

The type consists of two different specimens almost alike and collected at the same locality on different dates. In the same cover resembling these specimens in the shape of the leaves there was another specimen without label which proved to be *Stachyurus salicifolius* Franch.

ANNONACEAE

Miliusa sinensis Finet & Gagnepain in Mém. Soc. Bot. France, LIII. 151 (1906); Contrib. Fl. As. Or. II. 151, t. 18 (1907).—Léveillé, Fl. Kouy-Tchéou, 29 (1914).

Evodia Lyi Léveillé in Bull. Geog. Bot. XXIV. 142 (1914); Fl. Kouy-Tchéou, 376 (1915).

CHINA. K w e i c h o u : Yuin-lin, *J. Cavalerie*, no. 3971, in 1912. (type of *Evodia Lyi*).

Cavalerie's specimen is in fruit, and though I have not seen the type of *Miliusa sinensis* and its description is based only on a flowering specimen, I have little doubt that *Evodia Lyi* belongs here, since the specimens before me agrees well in all its vegetative characters with Finet & Gagnepain's description and plant figured, and the fruiting carpels are borne on a peduncle as long and slender as that of the flowers figured. The nearly mature carpels, however, are glabrous, while the young carpels are described as "omnino villosa."

Fissistigma retusum, comb. nov.

Melodorum retusum Léveillé in Fedde, Rep. Spec. Nov. IX. 458 (1911); Fl. Kouy-Tchéou, 29 (1914).

CHINA. K w e i c h o u : Lo-fou, *J. Cavalerie*, no. 2994, April, 1908 (type).

This species in the shape, venation and pubescence of the leaves and also in the character of its inflorescence is very similar to *F. polyanthoides* (A. DC.) Merr., but the calyx-lobes are about 5 mm. long and taper from a triangular-ovate base into a slender linear-lanceolate point.

As Merrill (in Philip. Jour. Sci. XV. 125 [1919]) has pointed out,

the genus *Melodorum* of Hooker f. & Thomson and later authors is not congeneric with *Melodorum* Loureiro whose type species is *M. fruticosum* Lour., and he adopts *Fissistigma* Griff. as the next oldest name for *Melodorum* in the sense of Hook. f. & Thoms.

Fissistigma Cavaleriei, comb. nov.

Uvaria Cavaleriei Léveillé, Fl. Kouy-Tchéou, 29 (1914).

CHINA. Kweichou: Tou-chan, *J. Cavalerie,* Oct. 1899 (fl. blanc-jaune).

This is another species of *Fissistigma* and not an *Uvaria;* it resembles somewhat *F. Oldhamii* (Hemsl.) Merr., but differs in its denser, fulvous and more villous tomentum, acute or acuminulate leaves, in its much smaller sepals, only 1–2 mm. long and glabrous inside, and narrower petals. The flowers seem to be always solitary.

LAURACEAE

Cinnamomum Mairei Léveillé in Fedde, Rep. Spec. Nov. XIII. 174 (Feb., 1914); Cat. Pl. Yun-Nan, 150 (1916).

Cinnamomum argenteum Gamble in Sargent, Pl. Wilson. II. 67 (March, 1914).

CHINA. Yunnan: forêts de Long-ky, 700 m., *E. E. Maire,* June 1912 (arbre moyen; fleurs grises; type).

Cinnamomum argenteum has been already enumerated by Léveillé (Cat. Pl. Yun-Nan, 150) as a synonym of his *C. Mairei.*

Cinnamomum glanduliferum Meisner in De Candolle, Prodr. XV. pt. I. 25 (1864).

Machilus Dominii Léveillé in Fedde Rep. Spec. Nov. XIII. 174 (1914); Cat. Pl. Yun-Nan, 151 (1916).

CHINA. Yunnan: forêts de Ku-long-tchang, 800 m., *E. E. Maire,* July, 1912 (petit arbre; fleurs blanches; type of *Machilus Dominii*).

Machilus Cavaleriei Léveillé in Bull. Geog. Bot. XXIV. 142 (1914); Fl. Kouy-Tchéou, 221 (1914).

CHINA. Kweichou: Gan-chouen, *J. Cavalerie,* no. 2131, May 1912.

This differs from all other Chinese species of *Machilus* known to me in its obtuse prominently reticulate leaves.

Notaphoebe omeiensis (Gamble) Chun in Jour. Arnold Arb. VIII. 21 (1927).

Lindera Cavaleriei Léveillé in Fedde, Rep. Spec. Nov. X. 371 (1912); Fl. Kouy-Tchéou, 219 (1914).

Machilus Mairei Léveillé in Fedde, Rep. Spec. Nov. XIII. 174 (1914); Cat. Pl. Yun-Nan, 151 (1916).

Machilus Dunnianus Léveillé in Fedde, Rep. Spec. Nov. XIII. 174 (1914); Cat. Pl. Yun-Nan, 151 (1916).

Alseodaphne omeiensis Gamble in Sargent, Pl. Wilson. II. 70 (1914).

CHINA. Kweichou: Tsin-gai, Kao-po, bord des ruisseaux, *J. Cavalerie,* no. 1222, Aug. 5, 1903 (petit arbre; type of *Lindera Cavaleriei*). Yunnan: forêts de Long-ky, 700 m., *E. E. Maire,* May, 1912 (arbre;

fl. blanc-jaunâtre; type of *Machilus Mairei*); collines boisées à Long-ky, 700 m., *E. E. Maire*, June, 1912 (petit arbre, fl. blanches; type of *Machilus Dunnianus*).

I can see no specific difference between *Machilus Mairei* and *Machilus Dunniana*. Léveillé gives as chief difference the lateral not axillary panicles of *M. Mairei* and the axillary many-flowered panicles longer than the leaves of *M. Dunniana*, but in the type specimen of *A. omeiensis* the panicles are borne partly in the axils of the leaves and partly lateral on the basal leafless portion of the branches exactly as in the type of *M. Mairei* in which they also are partly lateral and partly axillary. In *M. Dunniana* the panicles happen to be all axillary and they are somewhat larger than in the types of *A. omeiensis* and *M. Mairei* which agree perfectly with each other, but they are still shorter than the leaves and not longer as described by Léveillé.

This species was originally described by Gamble under *Alseodaphne*, but as Hu points out the unequal and persistent perianth removes it from that genus and points to *Notaphoebe*.

Neolitsea spec.

Litsaea Dunniana Léveillé in Fedde, Rep. Spec. Nov. IX. 460 (1911); Fl. Kouy-Tchéou, 220 (1914).

CHINA. K w e i c h o u : forêts de Gam-go, *J. Esquirol*, no. 565, Dec. 15, 1905 (arbre; type of *L. Dunniana*).

This is remarkable for its large leaves densely villous-pubescent beneath.

Neolitsea spec.

Litsea undulatifolia Léveillé, Fl. Kouy-Tchéou, 220 (1914).

CHINA. K w e i c h o u : Pin-fa, Tou-chan, *J. Cavalerie*, no. 1954, March 14, 1900 (arbuste; fl. blanches, odoriferantes; type of *L. undulatifolia*).

This species in general appearance closely resembles *Actinodaphne confertifolia* (Hemsl.) Gamble, but is readily distinguished by the narrower leaves not glaucescent beneath and undulate at the margin, by the glabrous branchlets and the flowers with only 7–8 stamens.

Neolitsea spec.

Eurya Esquirolii Léveillé, Fl. Kouy-Tchéou, 415 (1915), nomen nud.

CHINA. K w e i c h o u : Gan-chouen, *J. Esquirol*, no. 3893, March, 1912 (type of *E. Esquirolii*).

I have not seen the original publication if there is one of this species; it is not cited in Index Kewensis. I have referred the three preceding species to *Neolitsea* on account of their flowers having 6–8 stamens, but I have not been able to identify them with any of the species described under this or an allied genus. As one or the other may possibly belong to a species described under another genus or to a species unknown to me, I prefer for the present at least, not to propose new combinations for these species.

Litsea cubeba Persoon, Syn. II. 4 (1807).

Litsea citrata Blume, Bijdr., 565 (1825).

Lindera Dielsii Léveillé in Fedde, Rep. Spec. Nov. X. 370 (1912).

Litsaea Dielsii Léveillé, Fl. Kouy-Tchéou, 220 (1914), nomen.

CHINA. Kweichou: Pin-fa, montagnes, *J. Cavalerie*, nos. 932, March 22, 1903, and no. 1299, Febr. 27, 1902 (syn-types of *Lindera Dielsii*).

In 1914 Léveillé enumerates Cavalerie's two numbers as "*Litsaea Dielsii*" without citing *Lindera Dielsii* as a synonym. Cavalerie's no. 932 is labeled in Léveillé's handwriting "*Litsea Cavaleriei* Levl.," but the species described under this name is Cavalerie's no. 65, referred by him later as a synonym to his *L. Esquirolii* which is identical with *Benzoin commune* (Hemsl.) Rehd.

Benzoin commune (Hemsl.) Rehder, Jour. Arnold Arb. I. 144 (1919).

Litsaea Esquirolii Léveillé in Fedde, Rep. Spec. Nov. IX. 459 (1911); Fl. Kouy-Tchéou, 220 (1914).

Litsea Cavaleriei Léveillé, l. c. X. 371 (1912).

Lindera Bodinieri Léveillé, l. c. (1912); Fl. Kouy-Tchéou, 219 (1914).

Lindera yunnanensis Léveillé, l. c. (1912); Cat. Pl. Yun-Nan, 150 (1916).

CHINA. Kweichou: bois de Tsai-men-tse, *J. Esquirol*, no. 372 July 2, 1905 (sous-arbre; type of *Litsaea Esquirolii*); Pin-fa, hautes montagnes, *J. Cavalerie*, no. 65, July 15, 1902 (arbrisseau 1–2 m.; type of *Litsea Cavaleriei*); environs de Kouy-yang; mont du College, bois de Kien-lin-chan, *E. Bodinier*, no. 2179, April 12–14, 1898 (syn-type of *Lindera Bodinieri*). Yunnan: environs de Yun-nan-sen, dans la grande ravine boisée, *E. Bodinier*, no. 105, March 21, 1897 (grand arbuste ou petit arbre, dioïque, plante mâle; syn-type of *Lindera yunnanensis*.)

Litsea Cavaleriei was referred by Léveillé himself as a synonym to *L. Esquirolii*. Bodinier's no. 105 (*Lindera yunnanensis*) differs from the typical form in the glabrescent branchlets and the smaller less pubescent leaves.

Benzoin glaucum Siebold & Zuccarini in Abhandl. Akad. Münch. IV. pt. III. 205 (Fl. Jap. Fam. Nat. II. 81) (1846).

Pirus brunnea Léveillé in Mem. Acad. Sci. Art. Barcelona, ser. 3, XII. no. 22, p. 19 (Cat. Pl. Kiang-Sou) (1916), nomen; non Léveillé, 1912.

CHINA. Kiangsu, *d'Argy*, no. 105 [1846–66].

Léveillé's enumeration of *Pirus brunnea* in his Catalogue of the plants of Kiangsu is apparently based on d'Argy's no. 105 which in Léveillé's herbarium is placed in the folder of *P. brunnea*. The type of his *Pirus brunnea* comes from Quelpaert, Korea, and is identical with *Photinia villosa* var. *laevis* (DC.) Dipp.

Benzoin touyunense, comb. nov.

Lindera megaphylla Hemsley in Jour. Linn. Soc. XXVI. 389 (1891).

Litsea touyunensis Léveillé in Fedde, Rep. Spec. Nov. XI. 63 (1912); Fl. Kouy-Tchéou, 220 (1914), as "*Litsaea touyounensis*."

Benzoin grandifolium Rehder in Jour. Arnold Arb. I. 145 (1919).

China. Kweichou: Tou-yun, *J. Cavalerie*, no. 1, Nov. 10, 1902. Cavalerie's specimen differs from typical *B. grandifolium* Rehd. (*Lindera megaphylla* Hemsl.) in the leaves being villous-pubescent beneath, while Hemsley describes the leaves as "glaberrima." Of the 23 specimens of this species before me all but two are quite glabrous and in the two pubescent ones the pubescence is not quite as conspicuous as in Cavalerie's specimen, the hairs being slightly shorter and sparser. The pubescent specimens are both from Hupeh, one from Ichang (E. H. Wilson, no. 302 in part, March 20, 1909) and one from Changyang Hsien (E. H. Wilson, no. 302 in part, Nov., 1907). As Wilson collected at the same localities also specimens with quite glabrous leaves, the pubescence apparently does not indicate a geographical variety, but only a form of slight value. Cavalerie's specimen differs from the other specimens besides in the pubescence also in the somewhat shorter and broader leaves, which do not exceed 14 cm. in length and are up to 4.5 cm. wide.

Unfortunately the identity of Léveillé's species was not known when I transferred Hemsley's *Lindera megaphylla* to *Benzoin* and changed the specific name to *B. grandifolium* on account of the older *B. megaphyllum* Kuntze. This adds another synonym to this species and at the same time makes the rare pubescent form the nomenclatorial type of the species, while the widely distributed glabrous form would have to be considered a variety or form, if it should appear desirable to distinguish the two forms.

CAPPARIDACEAE

Capparis Bodinieri Léveillé in Fedde, Rep. Spec. Nov. IX. 450 (1911); Cat. Pl. Yun-Nan 26 (1915).

Capparis tenera Diels in Not. Bot. Gard. Edinb. v. 90 (1912).—Non Dalziell.
Capparis subtenera Craib & W. W. Smith in Not. Bot. Gard. Edinb. IX. 90 (1916).

China. Yunnan: Yun-nan-sen; ça et là dans l'interieur de la ville; endroits inhabités, *E. Bodinier*, May 24, 1877 (petit arbre à branches épineuses; fl. blanches; type of *C. Bodinieri*); autour de Motsou, alt. 800 m., *E. E. Maire*, May [1912–13] (grand arbre épineux, toujours vert, luisant; fl. blanches; in herb. Léveillé); among scrubs on lava-bed to west of Teng yueh, lat. 25° N., alt. 1500 m., *G. Forrest*, no. 7589, May, 1912 (syn-type of *C. subtenera*); open pasture and in thickets on the hills west of Teng yueh, alt. 1500–1800 m., *G. Forrest*, no. 9721, March, 1913 (syn-type of *C. subtenera*).

Burma. Open situations in the Taping valley, lat. 24° 20′ N., alt. 600 m., *G. Forrest*, no. 9654, Feb. 1913 (syn-type of *C. subtenera*).

Capparis masaikai Léveillé, Fl. Kouy-Tchéou, 59 (1914).

China. Kweichou: Lo-kouen, chemin de Pin-fa, *J. Esquirol*, no. 3230, May 15, 1912 (frutex scandens; fl. blanches; syn-type of *C. masaikai*).

Reevesia Cavaleriei Lévl. & Van. has been referred to *C. masaikai* by Léveillé in his Flore de Kouy-Tchéou, but this must be a mistake, since Cavalerie's no. 2347 (not 3347, as cited) is *Reevesia pubescens* Mast.

I have not been able to identify this species with any previously described *Capparis*.

(*To be continued*)

NOTES

A key to the Conifers based on leaf characters.—Under the title "Coniferae: keys to the genera and species, with economic notes"[1] H. M. Fitzpatrick has published a paper which aims to facilitate the determination of Conifers by the morphology of their foliage. Including the Taxaceae 47 genera are recognized. There is a key to the genera based on vegetative characters. The brief generic descriptions include also cones and seeds and are followed by remarks on the economic importance of the principal species and their cultivation. A key to the species of each genus is given with short description of each species. In most genera all or nearly all species are enumerated, but in genera like Callitris, Dacrydium, Podocarpus and Juniperus only the more important species are mentioned. The keys are not carried down to the individual species, but lead only to groups of species and it is left to the reader to find in the brief descriptions the differentiating characters. There is a special key (pp. 236–241) for the species of Cupressus, Thuya, Biota, Microbiota, Thujopsis, Libocedrus and Fokienia, which cannot be separated generically by vegetative characters; juvenile forms of these genera are not included in this key nor are they mentioned in the descriptions. A drawback of the paper is the lack of synonymy. There are e. g. no synonyms given of *Picea alba*, *P. nigra*, *Tsuga Pattoniana*, *Pseudotsuga Douglasii*, *Larix leptolepis*, *L. americana*, *Pseudolarix amabilis*, *Pinus austriaca* and others which in many recent publications bear other names; under *Abies brachyphylla* the author cites only *A. umbellata* Wilson [sic!], but not *A. homolepis*. In the bibliography at the end of the paper one misses such important works as Shaw's "Genus Pinus" and "Pines of Mexico," Bailey's "Cultivated Evergreens" and Silva Tarouca & Schneider's "Unsere Nadelhölzer." The seven plates contain 76 drawings chiefly of branches and they will facilitate the determination of specimens particularly in the Cupressineae which are especially well illustrated. The paper will certainly be very helpful in the identification of coniferous specimens without cones and may be considered a valuable supplement to other larger works on Conifers in which no special attention is paid to vegetative characters.—A. R.

[1] In Scient. Proc. R. Dublin Soc. XIX. n. ser., no. 19, pp. 189–260, pls. 9–15 (1929).